November 1983 90p

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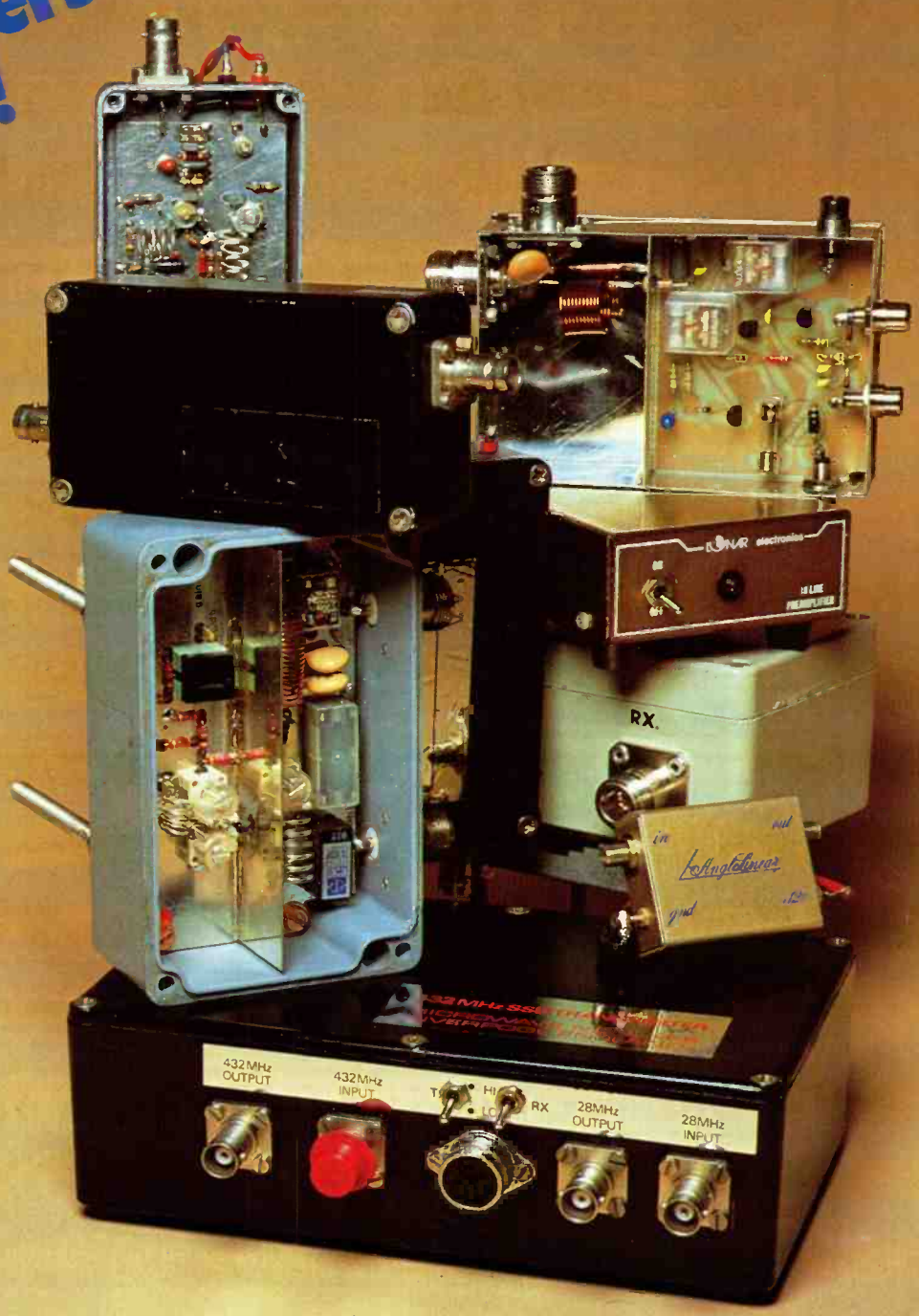

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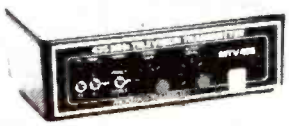

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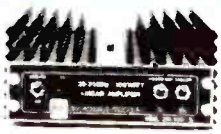

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Amateur RADIO

4 Current comment
A quick introduction to this issue, and a look at some of the latest goings-on at our Bicester offices.

6 Sir!
Love us or hate us, this is the place to say so. A variety of views about both the magazine and the hobby.

10 Straight and level
The news pages: this month we look at the Space Shuttle flight with Owen Garriott W5LFL aboard, and how to get the latest information about when he'll be on the air.

12 Angus McKenzie report
A mountain of VHF and UHF preamps, converters and transverters Come under the scrutiny of the G3OSS laboratory this month, with special attention to noise figure and gain. Very revealing: keep your wallet locked until the end!

21 SWL
The listeners' pages; and your questions answered. We've big plans for this column as you'll see.

24 160m for next to nothing
Your amateur band receiver not got 1.8MHz? It has now, if you have a go at building this simple converter design by Rev. George Dobbs G3RJV.

28 On the beam
More topical information for VHF/UHF operators from Glen Ross G8MWR.

31 Message in a bottle?
Otherwise known as the Triode Story. This month we look at triodes as RF amplifiers, and how to keep them stable by neutralising them. Lots of circuits and hints from Ken Williams.

40 Loose couples
No chance, not at the BBC. Auntie didn't stand for any hanky-panky in the Twenties. The title is a cryptic reference to the RF interference problems suffered by broadcast listeners back in 1925, when the **Radio Times** gave guidance on how to deal with the "blooming nuisance". Pure cheek.

43 A Morse tutor program for the Sinclair Spectrum
There are a lot of them about. This one, however, has been chosen for its simplicity.

44 Quarter wave verticals
John Heys G3BDQ's latest episode in his series on wire aerials looks at ways of supporting quarter wave verticals that you won't see in the text books.

48 One titled owner
Hugh Allison G3XSE sends us another dispatch from the second-hand front.

49 Starting from scratch: procedures
More on Morse from Technical Editor Nigel Gresley; this month he looks at some of the jargon you might hear on a VHF contact.

52 In the lab and the shack
Angus McKenzie takes a critical look at microphones used with amateur equipment, and makes a plea for more standardisation between different makes.

56 Pass the RAE:8
Time to sit down and put on the thinking cap: Nigel Gresley explains about 'charge' in capacitors, and looks at the different types of capacitor and their uses. Pay attention!

60 On test: two from Datong
A quick change act as N.G. takes off the mortar board and gown, and dons a white coat to examine David Tong's latest designs: the SRB2 Woodpecker Blanker and the ANF Auto Notch Filter.

64 Club news
We've had a meeting of the Committee ... and decided to ask all club secretaries to make sure they're letting us know what they're up to.

66 The Spark Transmitter
Leonard Moss looks at ship transmitters of yesteryear.

69 Dealer profile: Amateur Radio Exchange

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CURRENT·COMMENT

Introducing you to this month's issue

Another month has gone by and here's the next exciting episode. Angus has been hard at it as usual, this time reviewing the mountain of boxes pictured on the front cover. If you're looking for a VHF preamp, converter or transverter then this article is just the job.

Lighter stuff in this issue includes a look back to 1925, when the Radio Times printed advice to broadcast listeners about preventing interference from amateur stations. Something about 'loose couples'. The BBC didn't stand for any nonsense then!

In another article Leonard Moss explains how spark transmitters of the Twenties worked. The interference was matched by the noise and small produced in the radio room!

George Dobbs, of G-QRP Club fame, has again been busy with the soldering iron. This month he describes a Top Band converter project, to help receivers that refuse to go slower than 3½ megs.

Assuming that someone hasn't accidentally put it in Technical Bod's microwave sandwich toaster, we should have a review of two new Datong boxes in this issue somewhere. One of them is for zapping tuner-uppers, the other disconnobulates the Poltava Pest. I say we ***should*** have this review, because I don't want to tempt fate, not after last month when the piece about two Metalfayre aerials was sucked into the dreaded Black hole of Bicester.

"Black hole of Bicester"

On a more mercenary note, I'm delighted to see that all three of my local newsagents are now stocking ***AmRad.*** And I didn't need to fire a single shot. I'm almost as delighted to see that the only one of them who stocked The Other Mag has finally realised his folly and given it the old heave-ho. So if your newsagent is a bit of a Brian, and a bit iffy about stocking this really amazing mag, tell him what he's missing! If he's still just as iffy, why not take out a subscription? It doesn't cost any more, because we can send it POST FREE! (Memo to Art Editor: is there any way of making the last two words flash on and off, or change colour? - Ed.) (Memo to Editor: You obviously had a good lunch - Art Ed.) (That's enough memos - MD.)

Being serious, but not for long, we seem to be receiving a lot of letters from readers who want us to print information about short wave broadcasting stations. What do ***you*** want us to do? Would you like us to use, say, two or three pages a month to list English-language broadcasts beamed to the UK? Or should we stick to purely ***amateur*** radio? I quite enjoy listening to foreign stations while I'm pottering about the shack but not actually operating. Whatever you think, let us know and we'll act accordingly.

"Stop Scratching and Pass the Bottle"

Those are the editorial brainstorms for November; meanwhile back at this pearl of electromagnetic edification, (no Brian, you don't need to wear rubber gloves) other articles continue as usual - "Stop Scratching" and "Pass the Bottle" etc.

Who are those men in white coats...?

73 de G4DYA

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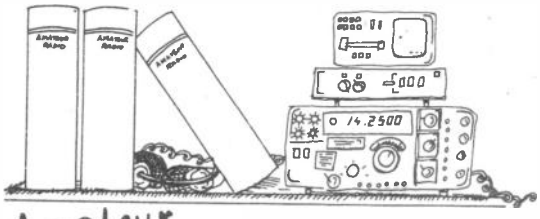

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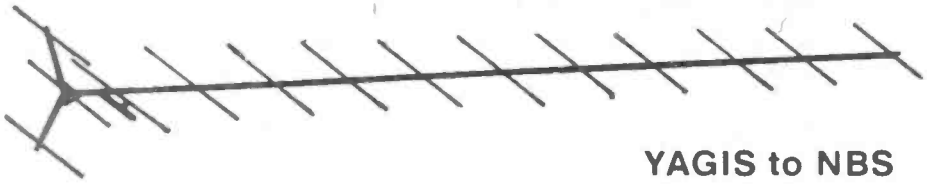

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WPO COMMUNICATIONS

To introduce ourselves to readers of this magazine we are listing most of our current products, together with a special offer on one of our kits — if you want more data then please contact us by phone or post. START THE WINTER WITH A CONSTRUCTIONAL PROJECT FROM US!

2 METRE FM RECEIVER — one of our early and popular kits, costing only £30.65. For this you get a 6 channel monitor receiver with <0.2uV sensitivity, no coils to wind (all pre-wound), S20 xtal included, i.f and roofing filters, and it works off +12v. We have a matching Transmitter to follow soon.

CAPACITY-ADD-ON UNIT — Whats this? A clever design which enable a Digital Frequency Meter to turn into a Digital Capacitance Meter. Measures from 1pF to lots of uF's. Only two connections needed to your DFM. Complete kit with case and pcb only £14.50. Works off +5 to +15v supply.

VHF PRESCALER — the cheapest kit on the market at £6.50! Divide by 10 prescaler which will raise the upper limit of your counter to 150MHz plus (typically 200MHz). Small, and comes with case.

ANTENNA MATCHING UNIT — the only kit on the market. Suitable for SWL's or QRP (up to 5 watts). Covers 1.5 — 30MHz, and intended for end-fed antennas or G5RV types. Match your aerial to your Rx and get more signals through. Easy to build and complete with case. £25.32

SIX METER CONVERTER — this one isn't available until December, but to whet your appetite it has a 28MHz i.f., is very sensitive, 20dB gain (variable) and easy to align. +12v needed. All coils prewound. PCB and components mounted on it are £14.00 or complete with diecast box and BNC connectors at £19.00

LOW COST TRANSCEIVERS - OUR MOST POPULAR kits with hundreds sold. Two versions — the DSB80 for 3.5 — 3.8MHz, and the DSB160 for 1.8 — 2.0MHz. Superb receiver (lots of people have been very complimentary about it) with on-board audio amplifier (1 watt). Double sideband (DSB) transmitter and CW with 3 watts or more output. VFO controlled and +12v operation. All built on one pcb and the kit is complete with slow motion drive, but no speaker or mic (crystal). Price for either kit is £37.45. We also have a punched case for the rig at £21.65 including hardware, and if you want to go all the way, a Digital Readout (ready built and which will fit the case) at £24.10 including mounting bezel. All three items for £77.00. IDEAL FOR BEGINNERS or QRP enthusiasts. Comprehensive instructions are included. DISCOUNTS for Club purchases of 5 or more.

**** SPECIAL OFFER TO AMATEUR RADIO READERS — DSB80 OR 160 BASIC KIT ** ONLY £34.00!! OFFER CLOSES 24TH DECEMBER 1983**

GET ON TO HF WITH OUR TRANSVERTERS - if you have a 2 metre multimode transceiver, then you can use its facilities (memories, scan etc.) on the HF bands BOTH TRANSMIT AND RECEIVE. We have two versions, one for 160/80 & 40 metres, and the other for 20, 15 and 10 metres. Either version just plugs into the VHF rig, and the unit converts to 2 metres on receive, and down to HF on transmit. Rf sensing for changeover avoids any mods to your rig. Very sensitive (average is <0.5uV at HF when used with most 2M rigs) and offers 2 watts minimum on Transmit - usually 3 watts (any mode your 2M rig has). Compact unit built on 2 printed circuit boards. It also offers direct frequency translation from your VHF rig dial i.e. 14.213 = 144.213MHz. Kits come complete with the 3 crystals required. Priced at £72.75 for the 20-10M version, and £74.00 for the 160-40M type. (pcb pair only for either version at £8.50).

PROJECT OMEGA - we have had an overwhelming response to these kits for a High Performance HF Transceiver with over 100 people well into constructing it. Its a bit too complex to describe in full, but offers all HF bands in 1MHz segments, and most of the facilities found on far more expensive rigs. Intended for full break-in CW, but SSB option will also be available. If you would rather know what goes on in a Black Box, then try building this project. We would not suggest that raw beginners attempt it though! It is not cheap, but you should be proud of the result. Briefly, kits available so are are: Central IF Processing Unit (69.50), Preselector (11.00), Notch Filter (11.20), Active Filter (15.45), Sythesised VFO (104.00 inc. crystals), Frequency Display (31.00), QRP PA (21.00), Logic/Antenna Switch (solid state - 15.45) and Low Pass Filters (29.50). To come are the SSB adaptor, 100W PA, FM and AM units, VHF transverter, In-Line SWR bridge, and a ready punched and screened case. Diecast boxes for modules are available separately. PCB's are also available separately for all modules. Full instructions, articles and corrections included. We have a MAILING LIST/NEWSLETTER for this project - ask to be put on it if your are interested.

70CM PREAMP - a low noise, very small preamp which could be built into most rigs if needed. Either built at £7.90 or a kit at £5.90.

2 METRE PREAMP - again, very small and low noise. Kits at £4.50 or ready built for £6.50. Ideal for Phase III satellite reception.

All prices include VAT and Post/Packing. Allow 1-4 weeks for delivery if not ex-stock. All kits are complete with components, pcb's (drilled and tinned), wire and comprehensive instructions. Alignment/debug service available. EXPORT - please write for prices. CASH WITH ORDER - MAIL ORDER ONLY. Catalogue and more details on receipt of s.a.e. (large), or phone us.

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L·E·T·T·E·R·S

Own medicine

Reading your article "Straight and Level" you mention the problem of the Woodpecker. I thought perhaps you might be interested in a method of chasing it out of the bands. I was told this method by G3TOR when he was giving me a demonstration of satellite working. (He's worked with the Russians and Yanks on their satellites). I won't swear to its effectiveness as I find it difficult to get just right. However, working on the principle of giving an infinite number of monkeys an infinite number of typewriters and one will produce a masterpeice; then if we all try this every time it appears one of us will get it right!

First an electronic key is required. Set the speed of the dashes to match the speed of the Woodpecker exactly (not easy). Tune in the Woodpecker. (I use an S-meter as it's so broad banded.) Now give the key a burst. If it's right, the 'pecker stops for 30 secs and starts again. Repeat and once more it stops for 30 secs and starts again. Repeat for a third time, and this time it changes to another band for 20 minutes. Apparently a false image appears on their radar receivers.

I think it's worth a try, but I hope other operators do better than my last attempt. I got a prompt reply of "QRZ this frequency"!

C. M. Maceke G4LXN
Chipping Sodbury, Bristol.

Deliberate mistake

If someone hasn't done so already, I claim the prize for finding the deliberate mistake in August's mag! In your series on how to pass the RAE, Question 2 gives a 10k resistor as having a current of half an amp passing through it when there is 50V across it. Using ohms law, I = V/R = 50V/10k = 5mA.

It's alright having a deliberate mistake every month for a bit of fun, but why have it somewhere where people are trying to learn new concepts and could easily get confused?

I am hoping to pass the December RAE examination and should be on HF sometime next year. Reading the ads in the mags would be enough to discourage many a hopeful amateur, and 'homebrewing' is out of the question for many who have only just managed to cope with Welsh caravans and mutual inductances etc. The price of some of the gear makes my £200 budget seem hardly enough to purchase an ATU! As an alternative I will probably buy something like an old KW rig and hope that it doesn't pack up before I have become experienced enough to mend it!

I am sure that there is a market for cheaper HF gear from Yaesu etc., at about £100-£200 which could dispense with synthesizers, digital readout, etc., while providing the basic requirements for operation, leaving some of the work to the operator. This would be more interesting and challenging for him.

Talking of cheap equipment, some time ago I bought an Amstrad model 6011 multiband radio set, primarily to listen to the shortwave broadcast bands. After logging about fifty countries, I turned my attention to the 'ham' bands. After building a one transistor BFO circuit, I was amazed with what this £30 radio could pick up. I have recieved strong signals from VK stations on 20 metres, also Americans, one in Panama, one in Puerto Rico and an operator with a TS130 running 10 watts in Venezuela (DX by any standards). Although of course not in the same class as a proper receiver, it has served the purpose of teaching me all the operating procedures, Morse etc., with a little help from RSGB publications and your mag!

I like the way that you keep your magazine understandable, without publishing complicated articles for the people with B.Sc., qualifications. There are already plenty of very technical publications where they can get those sorts of articles, without you losing any readers! After all that, thanks for the great mag, the free ads being a very good idea.

Philip Pavelin (15),
Harlow, Essex.

There would certainly be a huge demand for transceivers in the £100-£200 bracket. The trouble is that it just isn't possible to make them for that sort of price even if you do scrap the digital gizmos - it isn't those that cost, but the RF stages. Good luck with the RAE. - Ed.

Co-ax

This letter is about co-ax available to the amateur. There is only UR76, UR43, UR67 and the new H100. (OK - Andrew's - for the rich.) At 144MHz UR43 loses about half the signal at about 50feet - so there is only UR67 and H100 at this frequency. The point I wish to make is that there must be lots of very good TV 75 ohm cables. At 600 plus MHz it will have to be good. And possibly a lot cheaper than the solid stuff we are stuck with.

What I would like to know is - am I wrong in this assumption? When I started ham radio everybody used 75 ohm feeders.

Why oh why did they change to 50? Nobody seems to know. What advantage has 50 ohm over 75 ohm?

If a case can be made out for using 75 ohm co-ax could amateur gear be adapted to use it?

Or, alternatively, could cable manufacturers modify their 75 ohm cables, (say slightly thicker inner wires) to 50 ohm?

Questions, questions and more questions. I could be wrong about this - but I'd like some answers.

Hector Cole G3OHK,
Workington, Cumbria.

Back in the dim and distant past 75 ohm feeders were introduced because they offered the lowest loss for a given cost. 50 ohm cables, on the other hand, were supposed to offer the highest power handling for a given cost. Or so the story goes - perhaps the person who told it to me was pulling my leg. It wouldn't be the first time.

In many cases you can get away with using 75 ohm cables on 50 ohm rigs. It causes an SWR of only 1.5, which is next to nothing. But be careful if using it on an expensive transceiver with a transistor PA - some aren't tough enough to withstand much in the way of a mismatch - Ed.

Inventor found

In your article in September AR you mention that you never knew who made the W3EDP antenna. I have a 1938 call book and in it the holder of that callsign is H.J. Siegel, Tronton, N.J. By the way the call book cost 5/- and covers the whole world!

J.G. Bull,
Halifax.

Action Man

Terry Robinson VK3XCM describes Australia's *Amateur Radio Action* magazine as a "Boys Own Annual" in a letter in your October issue. I feel compelled to point out the irony in that letter.

Amateur Radio Action, like *Amateur Radio*, is privately owned and must sell each month on its own merits. If it is a "Boys Own Annual", I can only say that there are a lot of "Boys" in Australia who enjoy reading it. *ARA* sells some 20% more copies each issue than there are Amateurs in Australia!.

To match this circulation (all paid), *Amateur Radio* would need to sell some

L·E·T·T·E·R·S

50,000 copies per month. I don't doubt that you will reach this circulation in due course as you are presenting an excellent product to the Amateurs in the UK.

I believe that the recent world 'recession' was a testing time for most publications and *ARA* was no exception. Amateurs in Australia can purchase two local publications and some 10 or more overseas publications from the newstand. When money was in short supply, they chose to buy *ARA* over all others because it serves the needs of Australian Amateurs.

Our horizons have recently been expanded to include much of the Oceania region and I am pleased to say that sales in that region indicate that we are also well accepted outside Australia. Over our five and a half years of publication we have averaged some 90% locally written content, although we have exchange agreements with almost every international Amateur magazine. This, I feel, speaks for itself.

Amateur Radio Action's content reflects the activities of its readers as most of the articles are submitted by readers. On average, ARA articles are re-printed in other publications about five times more often than *ARA* re-prints another publication's material. This also speaks well for the standards we maintain.

We are not usually in the habit of replying to criticism in other publications but I must point out that Terry VK3XCM can no longer have his letters printed in Australian Amateur magazines ... they are awake to his motives. I trust you will permit me this right of reply.

Tony Gilbert VK3CE,
Editor,
Amateur Radio Action,
Melbourne,
Australia.

Aerial

I am a new SWL studying for the RAE, in a tiny cupboard in my home. I have just erected and I am insulating a 7ft x 5ft garden shed as a shack but do not as yet have an aerial system for this. I would like an aerial to cover all bands on my FRG7700 with FRT7700 ATU, and would be pleased to receive any help I can. I enclose a plan of my rear garden with measurements, also does the thickness of wire make any difference to reception in any way?

Can you also tell me if the trees will effect the reception.

Keep up with the good work on passing the RAE as it takes some sinking in with me.

D. Burton,
Redcar, Cleveland.

With a decent receiver and ATU like that any old bit of wire should do, as long as it is well insulated at the supports and operated against a decent (not just mains) earth system. If the wire is thick enough to support its own weight then it is thick enough not to affect reception.

Trees won't made much difference at HF, unless you live in the middle of a forest - Ed.

Technical competence

Re: Letters, Sept. '83: Surely the answer to Mr Berridge's question was contained in his own letter?

Should he study for and pass the dreaded RAE he would then be in a position to understand the design of basic components such as RF inductors, and so have little need to solicit magazine editors for such information.

Having also proved to himself - and others - that he had acquired a suitable level of technical competence, he would then be made welcome on the amateur bands.

The alternative, on his terms, would appear to be CB. The choice is his.

Incidentally, I found his dipole theory quite delightful!

H.N. Kirk G3JDK
Rotherham, S. Yorks.

Swahili

A comment on R.M. Fumbelow's letter in your September issue. I support his comments, as I also used the RSGB Examination Manual with the two sample papers for practice, and found the actual exam bore no resemblance whatsoever to these papers. I emerged from the examination room confident... that I had failed! And proceeded to the nearest 'watering hole' to drown my sorrows! To wrap it up in a nutshell I felt that I had been studying French for several months then took an exam in Swahili!

Keep up the good work in your pages. Au revoir.

John Rands G6XFD
Ainsdale, Southport

I must say I'm a bit surprised to hear comments like this. The City and Guilds of the London Institute, which sets the exam, says there has been no significant change in the syllabus for years. They did invite suggestions for improvements a few months ago which brought only about 25 letters. (And they say they could only take about ten of those seriously). If the RAE Manual is different from the exam I would suggest that it is the Manual that is wrong, not the exam.

The Exam in May can't have been all that bad, because 70.5% of those who sat it passed - Ed.

2B or not 2B

Having owned three Drake 2B receivers since 1960, the latest one refurbished recently, I can confirm all that Ken Williams says about its performance (September issue), and would add that the 2BQ unit comprising a notch filter, Q multiplier and loudspeaker is a must. The notch filter provides more than -50dB; a better performance than most modern equipments.

The sensitivity on the higher HF bands can be considerably improved if the 6BZ6 RF amplifier (V1) is replaced by a 6CB6, and the S-meter zero and sensitivity controls adjusted as per the handbook. A theoretical objection that the change to a sharp cut off pentode, 6CB6, rather than using a remote cut-off pentode, 6BZ6, should increase the cross-modulation distortion has not been confirmed in practice. No credit for this modification to me as I found it some years ago in QST "Hints and Kinks".

Two questions for Ken. Where can one get 8BN8 valves (the 6BN8 is not an acceptable substitute), and what is the simple mod which he mentions which extends the coverage down to 1.7MHz?

Lastly the real problem for those readers who may not realise that old valve equipments can perform just as well, if not better, than modern all-singing, all-dancing digital, non-'owner-maintainable' black boxes, is how to get hold of them. My Drake 2B is not for sale.

D.A. Barry,
St. Albans, Herts.

Improved

Browsing through the magazine racks here in the Orient, I came across your magazine (June issue - bought yesterday - the boats aren't as quick as a radio contact are they?). Having recently rekindled my interest in SWLing with the purchase of a Sony ICF 2001 (originally to listen to the BBC and VOA) I bought your magazine and I might say I was very pleasantly surprised. The last time I read an amateur radio magazine it was full of technical jargon and esoteric

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code which I couldn't fathom at all. So, firstly thanks for a magazine that your true novice can understand and not be put off the hobby (as I was many years ago by reading the mags. of that era).

Secondly, I am so impressed that I will put my money where my mouth is and take out a subscription.

Thirdly, you said you never get any letters - hope this one will cheer you up!

Finally, (at last I hear you say!) I wonder if you could advise any publications, clubs etc. that may help me set up SWLing again - I seem to remember award schemes for 100 countries and suchlike.

Oh! (did I hear your groan?) Please do give details of broadcast bands even only a paragraph or so - you see most of the amateur traffic I get here is in Japanese! And definitely the last thing - where can I get a list of designated callsigns or callsigns areas or QTH locators for world-wide SWLing - I seem to get a lot of American amateurs and broadcast stations but they all talk in W's and I've no idea what they're on about!

Thanks again for a great magazine - shame it only comes out once a month and takes 8 hours to read cover to cover - twice or three times!

Thomas Kirtley,
Hong Kong.

A list of callsign prefixes was published in our August issue - back copies are still available. QTH locator maps are published by various people. Intermedial Ltd., do a nice one - Ed.

Mouldy triffids

Re. MOULD, alias the triffids, on 432MHz+. They were very active on RB8$^1/_2$ (or SU8$^1/_2$ if you like - many people in London still use it as the calling frequency I think) recently especially during the Royal Visit or whatever it was. Seemed to be used as a normal PMR channel with handportables. I hasten to say that I don't go out of my way to receive them but as they use broadband equipment and high power (?) they open the squelch on my ancient FM rig and they come in uninvited.

Nothing we can do. Just hope that when the Top Brass find out that they share a band with amateurs they don't get us closed down. Top Brass are very security minded as a rule.

G3OSS was very upset by a MOULD station (what does MOULD stand for?) only 12.5kHz off the Harrow repeater and splattering all over it. He regarded it as provocative. But Alan at Hockley says it is such a sophisticated system (he has Pye contacts I expect) that whatever we amateurs do we cannot interfere with the Army - which is a blessing. I don't want to be up before a Court Martial.

Not so far fetched as you may think, seeing how fast the UK is now going to the Right.

Incidentally a combination of the new WT Act and the new Police Act could be powerful medicine - have you connected the two yet? Try it sometime. It depends on whether the alleged illegal transmitting is an arrestable offence (or thought to be an arrestable offence by the Constabulary). Do you know yet?

Don't publish MOULD frequencies, they can get you under the WT Act or the Official Secrets Act I reckon. PS, is MOULD for the Bomb or the Riots?

L.S. Chase G8BHT,
London.

As far as we can tell MOULD doesn't stand for anything; it's just a name. The military gave up using 'relevant' names for secret systems a long time ago, because they tend to let the cat out of the bag.

When I worked on another radio mag. we did publish a list of suspected MOULD frequencies, and we did expect some flak from the MoD about it. Not a dickybird. So now I assume they don't mind.

If they really wanted to keep it secret, they wouldn't have given it such silly frequencies, would they? Or did they want us to find out about it all the time? I think we should be told - Ed.

Skunk Hunt

Thank you for an interesting magazine even if your breezy style is startling at first. I have been a keen *constructor from the mid-40s* to the early 50s when work and family commitments took priority. Unfortunately over the years my junk box with dismantled F.J. Camms Air Hawk 9, Eddystone coils etc., have been lost. Your Top Band Cross Towner has restored the urge to start again. I think however that it would have been preferable to start this TX with provision from the start *for a VFO, a power supply* using a 350-0-350V 120 mA transformer that could be used for a PA with 616 or 807 valves and plug in coils for doubling to 80 metres. Do we have to have condensers with values in 'n' units (C5,7,8,10,12 and 13) could we not retain values in mfd as was usual with valve projects and from your article on American interpretations still seems to be used in the states.

I agree with most of the article by G4PZA on airwaves abuse but on the issue as to pressurising the authorities to monitor our frequencies for abuses, I have considerable apprehensions. The thought of officials taking note of minor infringements in between the flagrant abuse is disturbing. I think that we should act positively ourselves and track the scum who are unfitted for the description of amateurs. I think that if Repeater Groups affected by the foul mouths and jammers held a DF skunk hunt with a substantial prize some results should be achieved.

The RSGB could take the lead in this matter and act as the clearing house for information received with any amateur implicated after being warned once only, being expelled from the RSGB and reported to the authorities.

mfd is, frankly, an out-of-date term. We'll stick to the accepted modern units - Ed.

Mutek board

Mr. Finlay's letter (October 1983 issue) raises and highlights an unfortunate misunderstanding. The article to which Mr. Finlay *refers* **(SWM)** actually describes the fitting of our RPCB144ub front-end board (for the Yaesu FT221/5 series) to the IC211/251 series of transceivers. This article was written some time before we had even formally designed the RPCB251ub! Quite obviously this article is in no way apposite to the installation of the RPCB251ub.

Actually, the RPCB144ub and RPCB251ub differ in quite a few respects, although superficially they may seem quite similar. Our fitting instructions take this into account. It doesn't therefore surprise us that by confusing Peter Connors' excellent *Short Wave Magazine* and our installation notes Mr. Finlay has landed himself in a somewhat sticky state!

We will always support our products. In the case of the RPCB251ub, we have had a very few customers who have encountered problems beyond their capabilities. In these cases we've always been more than happy to make their transceivers work properly, although we have normally made a notional charge. It is a pity that Mr Finlay did not avail himself of our offer when it was made initially. This offer still stands!

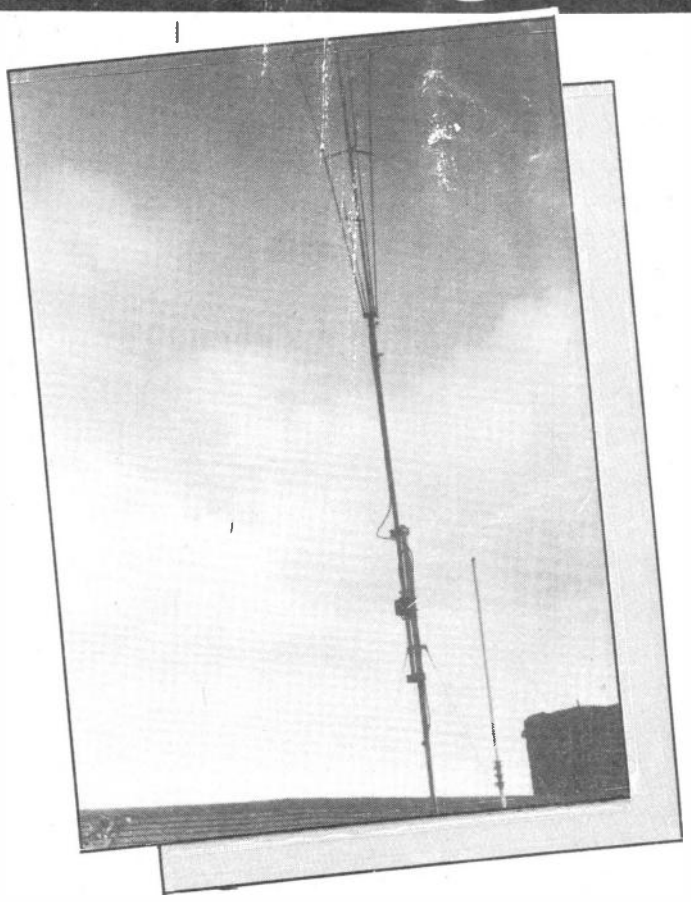
Stephen Prior, Director
Mutek Limited.

L·E·T·T·E·R·S

Up the pole

Please find enclosed two photographs which you may like to consider for publication. They show a local Cber's antenna. Note that it is mounted on a rotator. Does he know something we don't or has he just met a good salesman?

D.J.R.,
Sidcup, Kent.



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STRAIGHT·AND·LEVEL

The six-day flight of the Space Shuttle Columbia (STS-9), with mission specialist and radio amateur Dr Owen Garriott W5LFL aboard, looks set for launch on Friday 28th October at 1630 GMT.

If everything goes according to plan, he should be operating on two-metre FM for about an hour a day, starting in the late afternoon on Monday31st October.

Dr Garriott will be taking a special Motorola 'handie-talkie' with him. First indications are that he will transmit continuously for one minute, beginning on the even minutes, then listen for one minute beginning on the odd minutes. (Hopefully everyone will make sure that their clocks are accurate to the second, or the interference will be, er, out of this world.) The idea is that Dr Garriott will listen for callsigns (don't send anything else) in the inevitable pile-up for a minute, then during the following minute read out a list of those he has heard. That will constitute a contact! Just as well really, when you think of the number of people who will be calling him, and that he will only be in range of any given station for about eight minutes at a time.

The choice of frequencies has been a serious problem, partly because of the need to pick channels that will not be a potential interference risk to other Shuttle systems, and partly because of the various two-metre allocations, band plans and channel spacings in different parts of the world. It now seems that 145.55MHz will be used when the spacecraft is flying over Region 1. Other frequencies had been considered but they were in either a beacon or a repeater sub-band. A further complication is that Owen Garriott's rig has 20kHz channel spacing!

The Shuttle will orbit at a height of 155 nautical miles (250 kilometres). Other orbital parameters are: period 90 minutes; inclination 57 degrees; increment between each orbit along the equator 22 degres.

Dr Garriott will operate his amateur station during his rest periods on the Shuttle flight. If anything should go wrong with NASA's main schedule of activities for the mission, amateur radio activity is likely to be one of the first things to get the chop.

The RSGB will be providing an up-to-the-minute news service on the Headline News tape on Potters Bar (STD 0707) 59312, from about a week before the mission. (Another possible source of information is the AMSAT-UK net on 3.78MHz.)

QSL cards and reception reports should be sent to the American Radio Relay League (ARRL) at this address: ARRL, STS-9, 225 Main Street, Newington, Connecticut 06111, USA.

Owen Garriott was born in Enid, Oklahoma, in 1930. He became interested in radio and electronics while at junior high school, and he took a BSEE degree from the University of Oklahoma in 1953, and an MSEE and a Ph.D from Stanford University in 1957 and in 1960. He was an associate professor at Stanford, teaching electronics, electromagnetic theory and ionospheric physics.

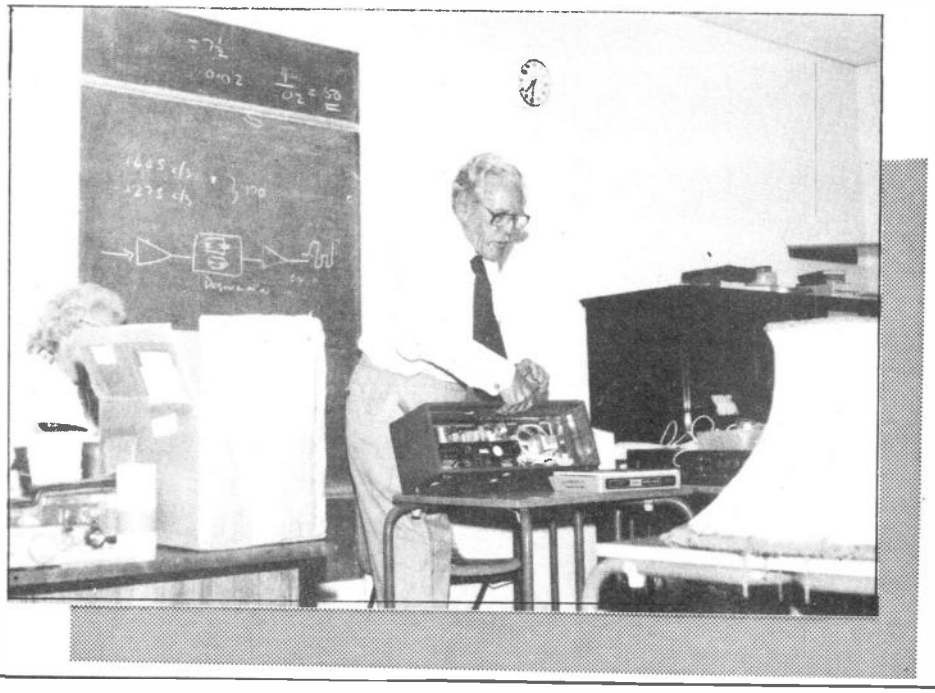
Garriott was an electronics officer in the US Navy from 1953 to 1956 and saw duty at sea in several destroyers. He has also logged more than 4,300 hours flying time, including some 2,500 hours in fast jet aircraft. He was elected by NASA as a scientist-astronaut in 1965, and was scientist-pilot aboard Skylab 3, which was in orbit from 28th July to 25th September 1973. He also spent 13 hours 43 minutes in three separate space walks outside the spacecraft. Since then, Garriott and his fellow scientist-astronauts have been working as mission specialists preparing for the Spacelab 1 flight aboard the Space Shuttle Columbia. When NASA decided to allow him to operate his amateur radio station aboard the flight, Garriott says that it was "... a dream come true" and the achievement of a project which has been on his mind since he first became an astronaut.

The Shuttle flight offers a great chance for publicity for the hobby in the media. The RSGB has sent a 'press kit' to the national newspapers and broadcasters, consisting of press releases not only on the Columbia flight, but also on the hobby generally, amateur satellites, Owen Garriott's career (used in this report), and the differences between amateur radio and CB. The RSGB is also offering back-up to local clubs wanting to use their local media to publicise the hobby.

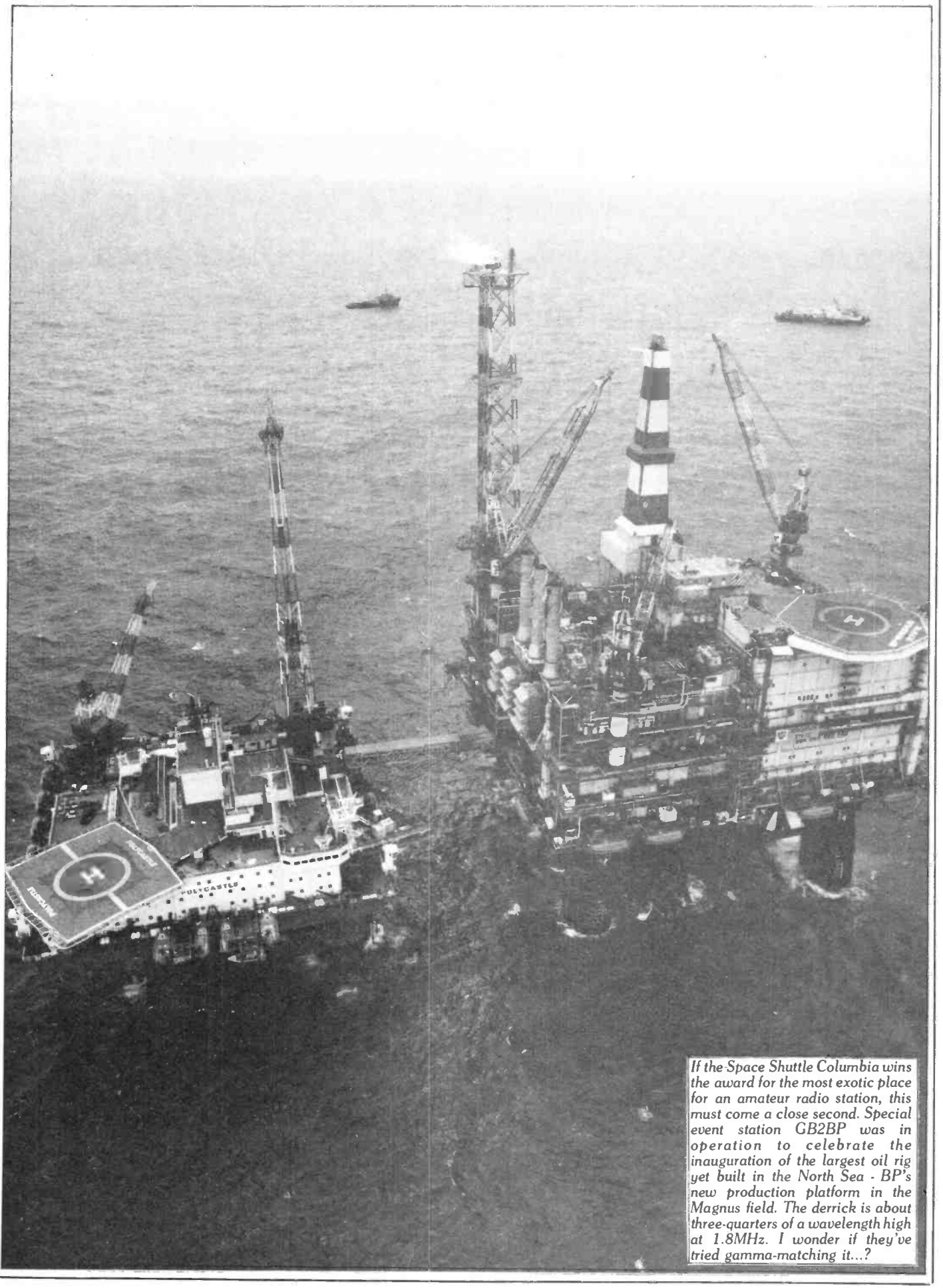
LBC

Not the commercial radio station in London where news allegedly comes first, but the London Bible College. The World Association of Christian Radio Amateurs and Listeners held their annual conference there recently, and they say they had a very good time with over 50 people present for the weekend, and a few day visitors. They worked about 300 stations with GB2LBC and have sent QSL cards to everyone they contacted.

They hope to use the London Bible College for next year's conference, but with GB2NJB as the special event callsign, as this is the closest they can get to the Association's normal callsign G3NJB.



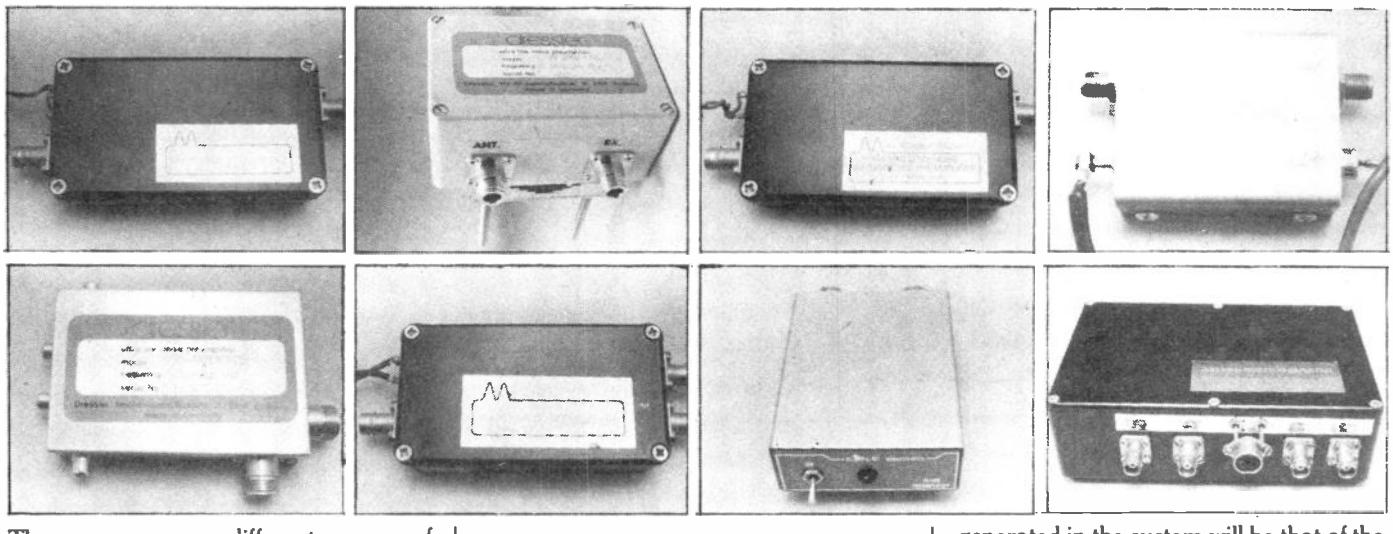
Bob Smith (G6TQ auctioning at the junk sale at WACRAL's recent conference at the London Bible College. Whatever the thing is, it isn't Owen Garriott's handie-talkie.



If the Space Shuttle Columbia wins the award for the most exotic place for an amateur radio station, this must come a close second. Special event station GB2BP was in operation to celebrate the inauguration of the largest oil rig yet built in the North Sea - BP's new production platform in the Magnus field. The derrick is about three-quarters of a wavelength high at 1.8MHz. I wonder if they've tried gamma-matching it...?

MEGATEST

Preamps, converters, transverters galore!



Angus McKenzie G3OSS

There are many different ways of measuring the noise figure and gain of RF devices. I have normally used a Rohde and Schwarz SKTU noise figure source and a B & K true RMS noise measurement meter. In July, Hewlett Packard very kindly loaned me their new super dooper noise figure measurement system, type 8970A with noise source, costing over £8,000, to measure several dozen pieces of equipment. This remarkable box of tricks measures both noise figure and gain, but in using the system, there are many snags. One has to be very careful not to misinterpret the indications, so we double checked many of the gain figures with a Marconi 2019 generator and Racal computerised power meter. Before launching into the results, let's look at what is meaningful in noise figures and gain, and discuss their relevance in a practical situation. May I refer readers to the earlier parts of my 'In the Lab and the Shack' series in the June and July issues of this magazine.

Every amplifier generates noise in its input stage, and this is amplified together with any signals with as low a background noise as possible. Noise figure is expressed in dB, relative to the noise that would be generated in a resistance of the rated source impedance at normal room temperature. An amplifier which has a 3dB noise figure generates 3dB more noise than would be generated by a 50ohm resistance at normal temperature. 'Normal' temperature is often regarded as 290K (Kelvin), which is 27 degrees Centigrade.

Unfortunately, many advertisers of RF preamplifiers etc. use the term noise factor incorrectly by quoting it in dB. Noise factor should just be a number, as it is a ratio of the noise generated compared with that from the 50 ohm source load. A noise figure of 3dB would be a noise factor of 2.

In practice, a noise figure better than 3dB implies that the amplifier is actually adding less noise than the source resistance, unless the latter is cooled below room temperature.

Matters now get interesting, for many people wonder why very low noise figure preamplifiers show much more benefit for some uses than the improved noise figure implies. If we consider a superbly matched antenna of 50 ohms impedance, with an almost loss-free cable to the preamp, and the preamp itself has an extremely good noise figure, well below 1dB, then almost all of the noise generated in the system will be that of the air and land at which the antenna is pointing.

If you beam at the sun then the noise will increase, but the sun's contribution will also be picked up on antenna side lobes. This in effect means that with a very good preamp, the system noise is almost entirely that of the earth's surface temperature, plus any additional noise created by atmospheric effects and, of course, general interference levels from cars and various household devices.

Supposing we have a superbly made 6m solid dish which has a dipole at the appropriate point connected to a super preamp. If we beam the dish up in to the sky in the middle of the night, the effective source noise temperature becomes that of the night sky, plus atmosphere noise. If you beam at the Crab Nebula, an extremely strong astronomical radio source, you will notice that the noise creeps up. Similarly, if you beam at a full moon in the middle of the night, you will notice the reflected noise caused by sunlight on its surface.

If you sweep the dish across the sky, you would see the noise rapidly bobbing up and down as different stellar objects come within the beam width. If you were to use a noisy preamp, then the noise variations would be much less.

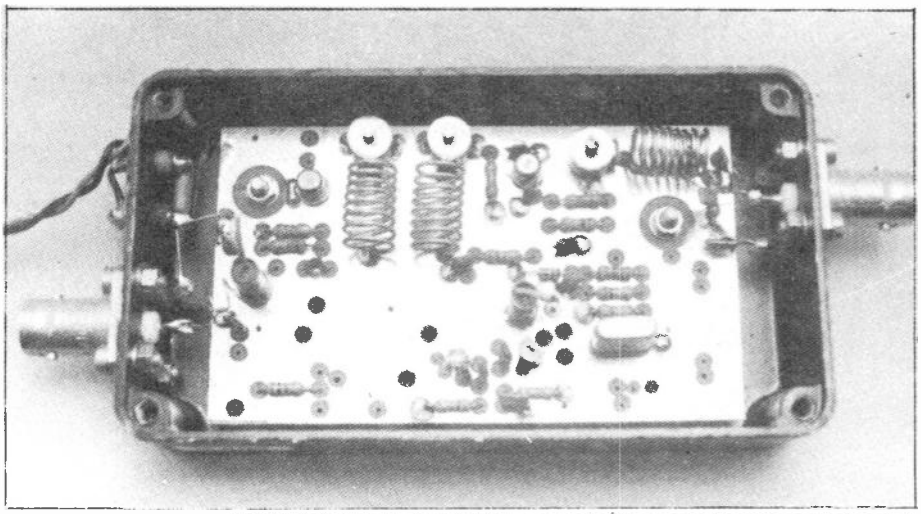
For normal terrestrial amateur radio contacts, we are concerned with beaming virtually at the horizon. On frequencies below, say, 30MHz, the noise contribution due to atmospheric effects varies greatly from an equivalent 7dB noise figure or so at the quietest moment in the middle of the night, when no ionospheric reflections are present, up to the equivalent of 15 or 20dB noise figure. This, in effect, means that unless you want to work nearby mobiles, or fixed stations by groundwave direct propagation in the middle of the night, you do not need a receiver system having much better than around 10dB noise figure below 30MHz. As frequency is increased, the atmospheric noise contribution etc. becomes lower and lower, so that by 145MHz a 3dB noise figure is useful, but going better than 2dB will not give any significant improvement. On 432MHz you won't get much advantage with preamps better than around 1dB but on 1296MHz you need as good a masthead preamp as you can get, for there are virtually no atmospheric effects in normal circumstances, and ignition noise can almost be ignored.

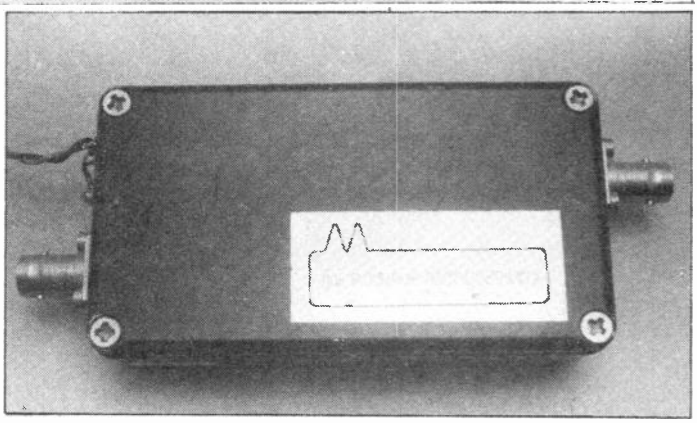
If you are going to do moon bounce, particularly during a new moon, or you are interested in radio astronomy, you can make use of a much better noise figure, but only if you have a dish which keeps out normal terrestrial noise.

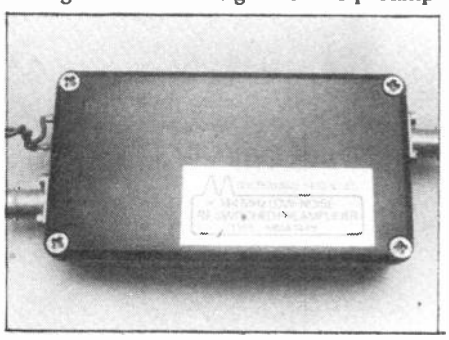
Now let's look at the typical performances in noise figure of average VHF and UHF 'black boxes'.

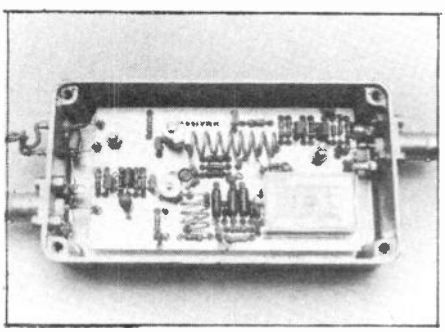
Black boxes

We would be lucky to see a Japanese front end in such a box substantially better than 5dB noise figure, and many are as bad as 7dB. A Liner 2 that I once measured was very deaf at around 10dB! An Icom 251E with a Mutek front end, will give a noise figure, remarkably, of around 2dB. A Microwave Modules preamp in front of almost any black box will give a *system* noise figure of between 1.5 and 2dB, although the preamp itself has a noise figure of around 1.4dB. In practice you will never see just a noise figure of the preamp, since its amplified front end noise has added to it the noise of the normal receiver front end. No matter how good the noise figure of the preamp is, you must consider its gain. The lower the gain, the less able the preamp will be to overcome the noise of the main rig. An incredible preamp with 0.5dB noise figure, and 10dB gain would give a system noise figure of as high as 3dB when feeding a black box with a 10.5dB noise figure.





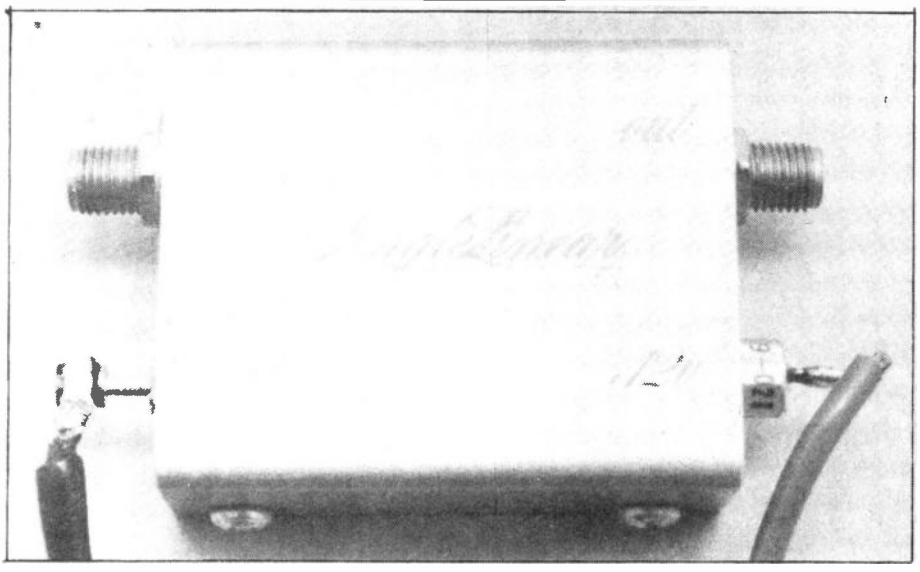


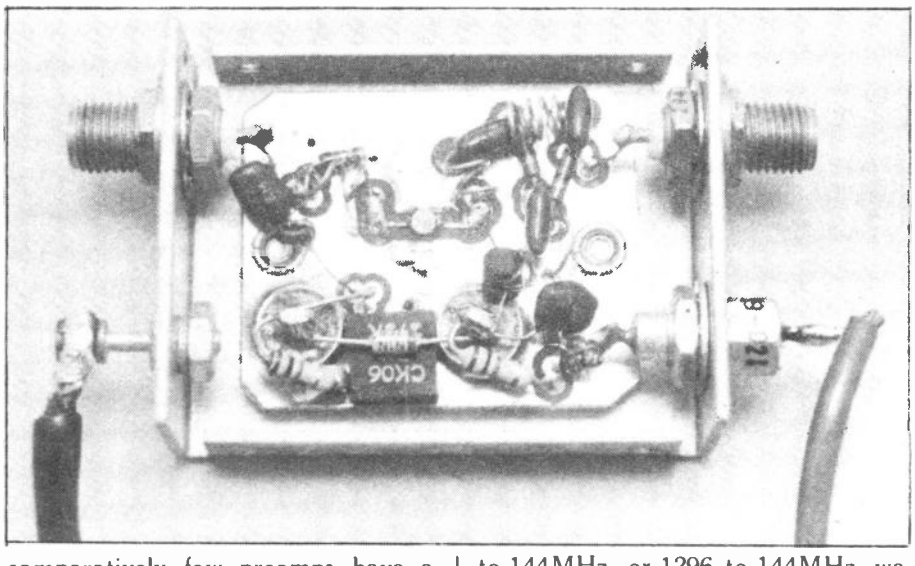


Most preamplifiers have between 8dB and 20dB gain from input to output, but alas, many transverters have a minimum of 25dB gain and as much as 38dB, which is grossly excessive. Looking at preamps first, let's see what happens when we add a preamp, taking a Microwave Modules 2m RF sensed one as an example, as it is a good one. It has (typically) a 1.4dB noise figure and a gain of say 15dB. Looking at a typical black box, it might develop a 1uV RFIM product from two off-frequency 1mV carriers, due to radio frequency intermodulation. If we add a preamp, then the off-channel signals would represent a level of say 5.5mV each, and so an IM product would be developed which was equivalent to around 180uV, i.e. 45dB above that which would be generated with the aerial connected directly to the black box. The actual ratio between the causatory carriers and the IM products has degraded by 30dB, within the black box front end, but the original signals have increased by only 15dB (the preamp gain). A 180uV product is a disaster, and even 1uV is rather insufferable. What happens if we have two signals, 15dB below 1mV (i.e. 180uV), each coming into the preamp? The levels into the main rig are back to 1mV again, and so a 1uV IM product is generated. The noise in the system however, will have increased, on average, by perhaps 12dB, because the black box contributes more noise in terms of signal to noise, so the preamp does not increase the black box noise by as much as you might think. The 1uV IP is thus closer to noise and less harmful. The overall result is that you will get a degraded IM performance as soon as you switch the preamp on, and if you are in an area such as Greater London, you will soon hear far more RFIM products than you hear without the preamp, unless your main rig is almost bomb proof! For this reason, all external preamps should be switchable and not permanently installed, so that you only need to switch them in when it is absolutely essential. The gain versus the bandwidth of the preamp is also important, since a wide bandwidth will amplify signals well outside the band, and cause distress, particularly to some of the poorer black boxes. Unfortunately,

MEGATEST

Preamps, converters, transverters galore!





comparatively few preamps have a very narrow bandwidth, and this makes one wonder if a preamp is really necessary. The point of issue here, in my opinion, is that the rig itself should be designed to have avery good noise figure as well as a good IM performance, and here lies the rub. We also have to consider the two-tone RFIM performance of the preamp itself. Most preamps are far better than the rigs following them, and the only ones that have degraded the system performance more than one would expect by the gain/black box combination, are some of the Dressler GaAsFET models which have an intercept point as poor as 20mV or so at their input.

Transverter gains

If we measure the noise figures of mnay HF rigs at say 28MHz, we would find that they are between 6dB and 10dB, although there are a few which are much worse. Assuming the 20dB figure, a transverter gain or only 20dB will almost completely overcome the HF rig's noise figure, so why do so many transverters have grossly excessive gain? I am totally perplexed as far as transverters down to 28MHz are concerned, but if we consider 432 to 144MHz, or 1296 to 144MHz, we can see the reason. Microwave Modules transverters, jfor example, are designed to work with low poer inputs at their IF, typically from just below 1mW to say, 500mW. Most black boxes deliver from 1W to over 10W, so Microwave Modules supply power attenuators to avoid overloading the transverter. A 15dB attenuator would cut 10W down to around 300mW. This level is manageabale, but the received oujtput manageable, but the received output signal from the transverter is also attenuated by the same amount, so that a 35dB gain transverter in effect, is reduced to a 20dB one. The use of such power attenuators may reduce aggro in installation, but is a very crude way of getting round the problem, and the transverter mixer is having to work much harder than it otherwise would if it had to give 15dB less output. When you use a transverter with a preamp as well, then you could get as much as 50dB gain in front of the HF rig, which is ridiculous, so you then stuff in a 20dB attenuator to cut it down. Even when you do this, you may find an S9 indication on your HF rig's S-meter, which is equivalent to perhaps only 1uV, so all your visual S-meters reports are uneblievably generous! Just have a look at the S-meter indicated level on noise - you may find it as high as S4!

Noise matching and alignment

Although a preamp or black box should be aligned to give optimum performance, usually from a 50 ohm source, its input impedance at the centre of the band is usually much higher than 50 ohms, possibly as high as 1000 in some cases. The input trimmers etc. have to be aligned to give the best possible signal-to-noise ratio, and very frequently this is far from maximum power gain. For this reason, if you try adjustments of front ends, you should never adjust inputs for maximum S-meter reading from an input signal. You may win a dB or two of signal to noise ratio if you adjust for best noise figure, and so what is the best way of doing this? A weak FM signal, when detected, is subject to a greater audio signal-to-noise change than the RF one, a 1dB improvement (in noise figure) to a signal at around the 12dB SINAD point giving up to 2dB audio improvement. I therefore suggest that if you really have to tune the front end, then do this on an FM signal by adjusting the trimmers for the optimum audible signal to noise. If you adjust for the point on each trimmer mid way between the points at which the signal-to-noise ratio begins to deteriorate, you won't be far out. If, however, there is a lot of band noise present, then it is essential to put in a 20dB or so attenuator right on the input to the front end. This will make it easier to hear the improvement of the front end itself, and prevent band noise masking front end noise in a good preamp. Once you have done this, you can then adjust the front end output trimmers for optimum gain and bandwidth. After this, you may get a small improvement in system noise figure by re-tweaking the front end trimmer again. Some preamps and transverters that I have checked have been badly adjusted, and front ends do seem to drift a bit after a year or two. I

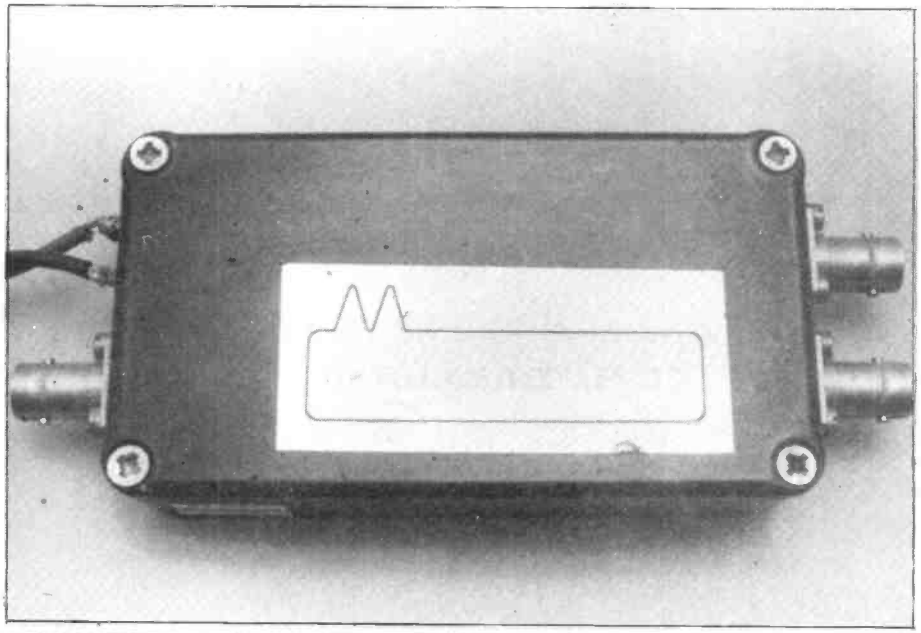
strongly advise you not to attempt tweaking unless you have a circuit diagram available as you could disturb some other part of the circuit which may be very difficult to put back without much test equipment.

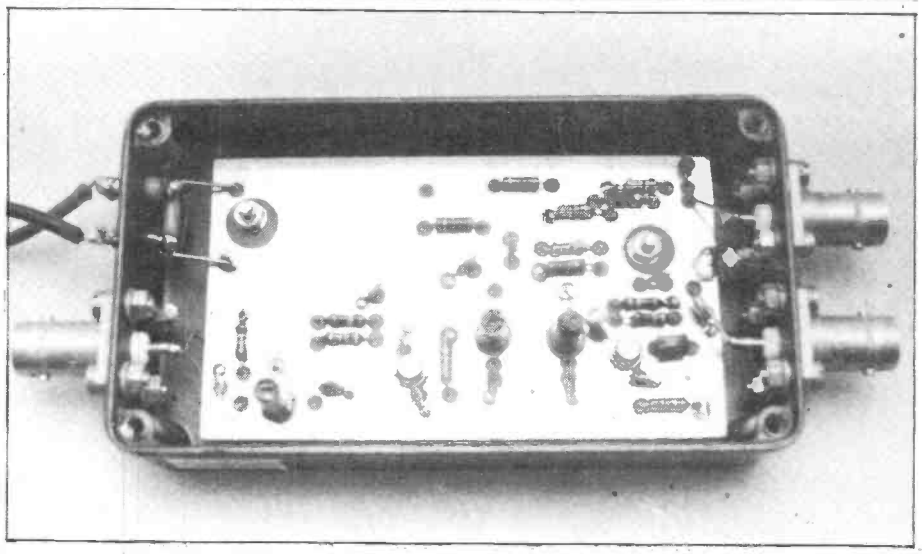
Preamplifier measurements

We decided to measure as many preamps as we could on bands up to 23cm, so not only did we look many of my own, but also SSB Products. Microwave Modules and H. Lexton (agents for Dressler) submitted various models for testing. Great care was taken to use the Hewlett Packard system precisely in accordance with their instructions, and we managed to avoid many pitfalls. We spent many hours getting to know the system, and finding ways of assessing the figures accurately, and while HP claim an accuracy of 0.1dB, I would prefer the figures to be regarded as +/-0.25dB or so, because of matching problems. We used filters wherever necessary to restrict the noise bandwidth if this was a problem.

We first had a look at a Microwave Modules 28MHz preamp which is intended to hot up deaf receivers on that band. My model, which I have had for some years, is not RF sensed, and contains two outputs, the lower gain one having around 15dB measured gain, while the higher gain is considerably greater. The 15dB output port is the one that should normally be used, unless your receiver is in very desperate need of an enormous deaf aid! The amplifier has always worked well, and as usual requires 12V DC powering. The noise figure was excellent, making it suitable for specialised applications, including immediately after a ring mixer, for example.

Around two years ago, Microwave Modules supplied me with an RF sensed 4m preamp having rather high gain, but a superb noise figure which is good enough for every reasonable application. This really can hot up the deafest of converters or transverters. I have been using it mainly to improve the rejection of out of band signals into my 4m MM transverter, and here lies an amusing tale which I am happy to admit. But please don't tease me too much about it!





At some time I must have had a lightning strike which had blown up the transverter front end, but I had not noticed it because of the preamp, (presuambly bypassed at the time of the strike). The transverter then had an overall noise figure of 16dB, with not too much gain! The system noise figure, though, was around 4.5dB with the preamp in front. I am so sorry that I have been mean on 4m reports in the last two years, but after Myles, G4RCE, had put a new RF transistor in, I was delighted to see a dramatic improvement! In practice, now I only need the preamp to reduce bandwidth, it giving only a marginal improvement to signal-to-noise ratio.

My own Microwave Modules MMA144V came out at 1.4dB, having a gain at band centre which is higher than more recent samples. Before we adjusted it though, it had had a noise figure which was rather worse as a result of my previous inept tweaking around two years ago! Please note in the table that several models were measured before and after adjustment, the latter being designated by the suffix "a". I highly recommend this preamp as it is switchable. My own model has much too short a hold time so it keeps dropping out on SSB. Furthermore, until fairly recently, they required a watt or so to hold them on transmit, but Microwave Modules have recently greatly improved the sensitivity of thgeir VOX sensing, as well as providing a pot inside to adjust the hold time, which is a great improvement. All Microwave Modules preamps are normally supplied with 50 ohm BNC input and output sockets.

Dressler GaAsFET

We had a look at two Dressler preamplifiers, the VV2000 and 200S models. The former incorporates a GaAsFET and is housed in a substantial metal box designed for masthead mounting. Very heavy duty bolts and clamps allow it to be mounted on a thick scaffold pole. Input and output connecters are 50 ohm N types. Whilst this model had a very good noise figure, it had perhaps too much gain for top quality installations. the main problem I found with both models was that the input RF intercept point is very poor indeed by comparison with other hot

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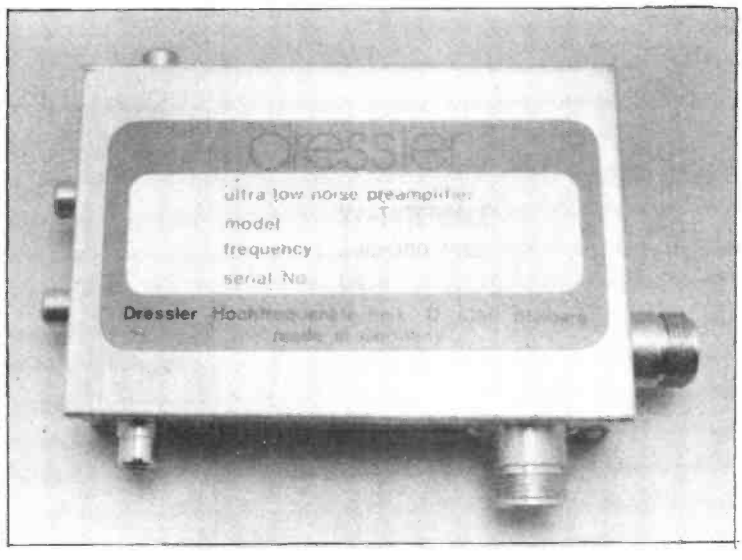
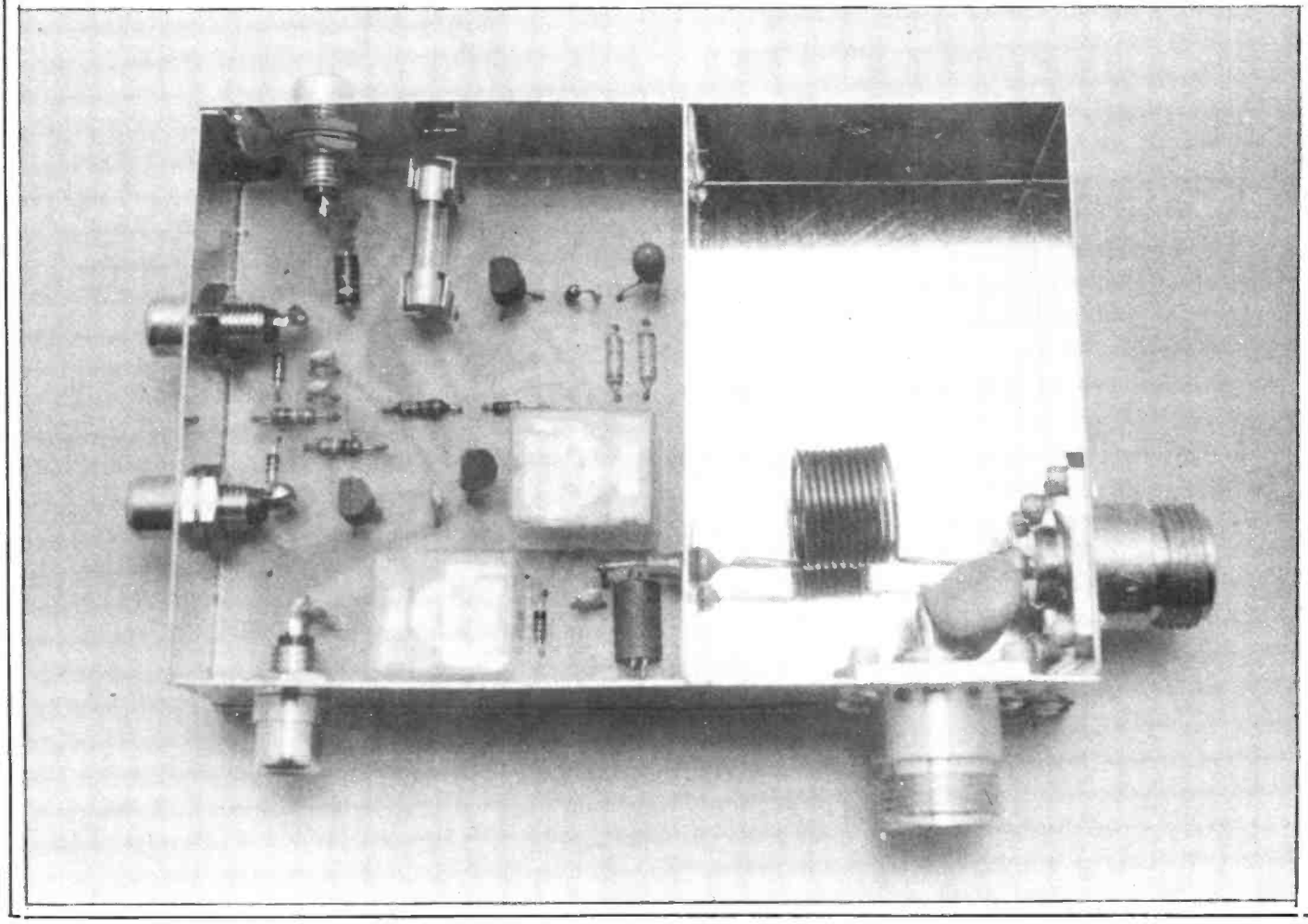
preamps. GaAs FETS are in fact not the linear devices that some people imagine them to be, although this problem can be overcome. This model relies on being activated for receive by the presence of 13V DC positive up the inner of the coaxial cable connecting the preamp/aerial to the shack installation. There is a Dressler 13V in-line power supply availbale, with connections for 13V DC input, a PTT line, a DC-volts-to-activate line, and an output line to operate a linear amplifier relay when this is safe, i.e. when the 13V DC is well and truly off the co-ax and the preamp relays have gone over to transmit. Dressler's 200S model is very similar but it does not employ such a good FET device. The 200S offers the capability of RF sensing as well as 13V DC switching on the co-ax line. I have the same reservations concerning the input RF intercept point as for the 2000, so I cannot recommend this model. There are, of course, separate connections for the 13V DC supply when the preamp is used with RF sensing.

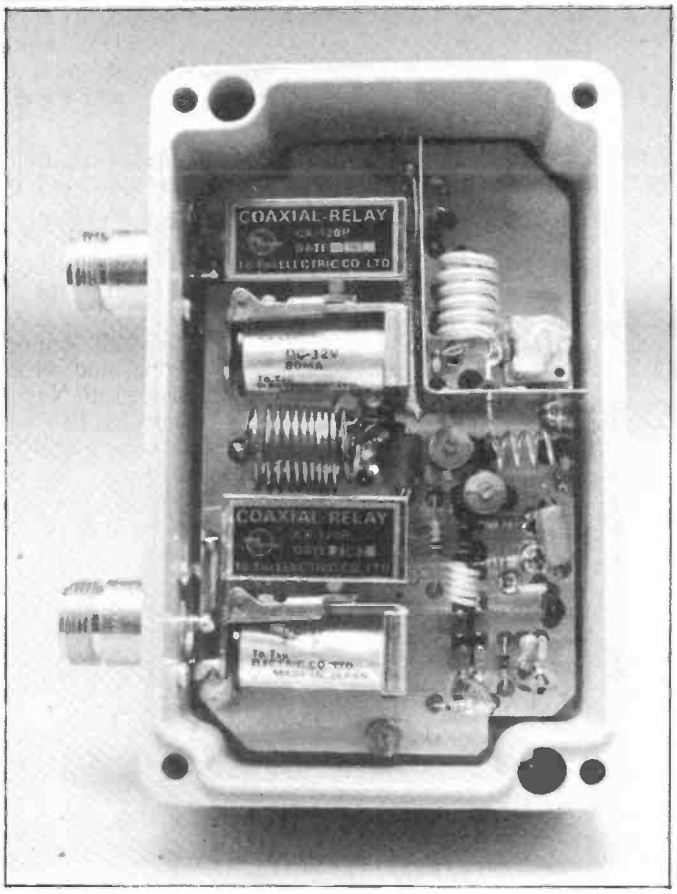
For some years, I have had lurking around the shack, quite a good little preamp with RF sensing, the Lunar PAT144R. Although fitted with SO239 sockets for input and output, (I don't really approve of these on VHF let alone UHF), it actually offers an extremely good performance, althought he gain is rather low. The noise figure is very good, and it can hot up a black box very well without very seriously degrading RFIM. The 13V DC input is on a phono socket, and there is a bypass switch. It is not really suitable for masthead mounting.

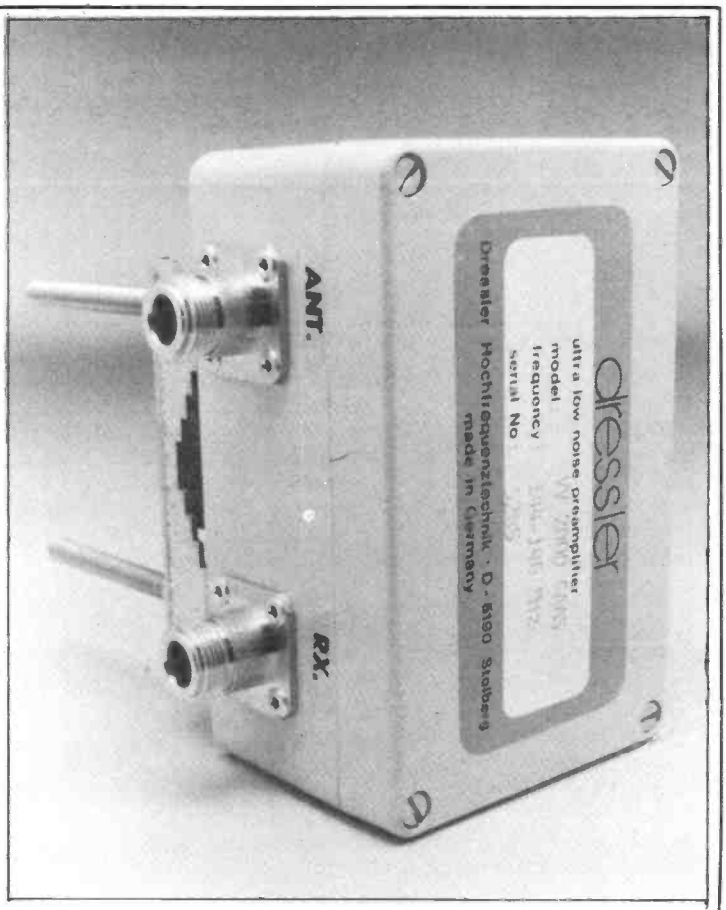
If you see one around, new or secondhand, I can recommend purchase strongly.

SSB Products, available from Piper Communications, offer a very wide range of extremely good preamps for 2m, 70cm and 23cm. Various models are available either for masthead mounting including relays, or for in-line mounting into the receive leads without relays. They all require around 13V DC powering, and an in-line 13V supply is available with N type sockets. It has connections for 13V DC input, PTT line input, linear amplifier









relay, this last having the usual time delay to switch on the linear after the relays have gone over to TX. The through-line masthead versions are mounted in boxes almost identical to the Dressler ones. The SSB Products ones also use N type sockets. The MV144G employs a GaAsFET, and gave a remarkable noise figure, quite a high gain. There was no time to measure the RF intercept point on these preamps, unfortunately, but they should be better than the Dresslers. Another older version using a more normal device in the through-line type box, requiring 13V DC powering on the coax inner, typically gives 1dB noise figure after very careful adjustment, being rather better than its spec. I have used one of these for years and it has worked extremely well giving me no trouble at all, although the noise figure is probably better than I actually need. These preamps typically draw around 150mA including the relay current. They can also take an extremely high RF power through them on TX.

We looked at quite a number of 70cm preamps, and one of the more interesting ones was the Lunar PAE432. The noise figure is reasonably good, considering the device is not a GaAsFET, but the SMA input and output sockets are rather tiresome, since plugs are expensive and difficult to come by. It has quite a useful gain, but its main problem is that its bandwidth is far too wide, and you may have interference problems since it amplifies band 4 TV as well! It requires 13V powering and does not include any bypass relays. It was originally designed for moonbounce work, and is probably not available now as it has been superceded. Unless you can buy one secondhand fairly cheaply, I don't really recommend it.

432 MHz

We had a look at two different preamp sections with Microwave Modules linears. The preamp in the MML 432/30-L had a reasonable noise figure, and not too much gain, and worked very well. You can certainly use the preamp in line without too much trouble in most situations. The preamp in the MML432/50 did not have such a good effective noise figure, and the gain was slightly lower. I would have expected a rather better performance for noise figure, but I believe Microwave Modules should be improving matters shortly.

The SSB Products SV700 had a reasonable noise figure, but the gain was far too high, and so RFIM problems could become apparent. The DX432 on the other hand, had an incredibly good noise figure for 432MHz, as good as I have ever measured on this band, and the gain was only slightly excessive. If you want something really hot for moonbounce work, then this could be a good choice. I feel it is too good for normal use though, as it is very costly. The DX432S was only marginally inferior on noise figure, and thus superb, but the gain was still rather on the high side. It would be another good choice for moonbounce work though, particularly when the aerial is pointing up to the sky, thus avoiding serious RFIM problems. For normal use, I can highly recommend the MV432 as it has an excellent noise figure, as good as you would ever need for terrestrial contacts, whilst having about the right gain for a good system. I have been using an SSB Products masthead preamp for some years, and it has always performed superbly well. It has enabled me to pick up extremely weak DX signals, and I have not normally experienced RFIM problems unless G3JXN and I happen to be beaming at one another!

SSB Products also make 23cm preamps, and they have now introduced a masthead one with extremely good performance, including relays. The DX1296 had an extremely good noise figure for the band, but the gain was rather low unfortunately (we need much more gain on this band to overcome cable losses). The DX1296S was significantly better both on noise figure (excellent), and gain, about right in a very good installation. A masthead preamp on 23cm makes all the difference in the world, and I achieved around a 9dB improvement when I first put one in, allowing me to hear beacons under normal circumstances which were inaudible before, other than in tropo ducts etc. The MV1296 had a useful noise figure, again very good for 23cm, but the gain was on the low side, despite us attempting to improve it with considerable tweaking. GaAs FET

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Table 1 Laboratory tests
NB(a) = after accurate setting up

1. 144 MHz Pre-amplifiers

Pre-amp	Gain (dB) 144MHz	145MHz	146MHz	Noise figure (dB) 144MHz	145MHz	146MHz
Microwave Modules MML144/100S	13.9	13.7	13.6	2.3	1.9	1.9
Dressler VV2000 GaAs	15.1	15.4	15.1	1.1	0.9	0.8
Dressler VV2000 GaAs(a)	15.6	15.6	15.0	0.7	0.6	0.6
Microwave Modules MMA144V	17.8	18.0	18.2	2.2	2.0	1.8
Microwave Modules MMA144V(a)	17.5	17.2	16.9	1.4	1.4	1.4
Lunar PAT144R	8.1	8.4	8.6	1.4	1.2	1.3
SSB Products MV144G	20.0	19.6	19.1	0.4	0.45	0.5

2. Noise figure and gain of transverters/converters
Measurement in middle of band

Model	Gain (dB)	Noise figure (dB)	Model	Gain (dB)	Noise figure (dB)
Microwave Modules MMT70/28	16.9	2.8	Microwave Modules MMC435/600	34.7	2.1
Microwave Modules MMT70/28 (a)	18.8	2.5	Microwave Modules MMT144/28	25.5	2.2
SSB Products 432/144	29.9	2.2	Microwave Modules (new model) MMT432/28	34.5	2.6
Microwave Modules (old model) MMT432/28	28	4.8	Microwave Modules (early version) MMT1296/144	37.6	4.7

3. 70&28MHz Preamps

Model	Gain (dB)	Noise figure (dB)	Model	Gain (dB)	Noise figure (dB)
Microwave Modules MMA28	24.4	1.7	Microwave Modules MMA70	20.1	1.2

4. 432MHz Preamps

Model	Gain (dB)	Noise figure (dB)	Model	Gain (dB)	Noise figure (dB)
Microwave Modules MML432/30-L	11.9	2.4	SSB Products DX432	17.5	0.5
Microwave Modules MML432/50	10.9	2.9	SSB Products DX432S	19.4	0.6
Lunar PAE432	16.2	1.4	SSB Products MV432	11.8	0.9
SSB Products SV700	21.2	2.0			

5. 1296 MHz Preamps

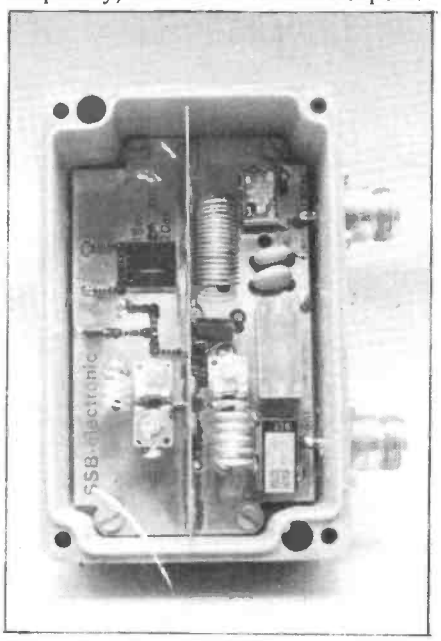
Model	Gain (dB)	Noise figure (dB)	Model	Gain (dB)	Noise figure (dB)
SSB Products DX1296	12.6	1.2	SSB Products MV1296	12.7	1.3
SSB Products DX1296S	15.9	0.9			

on 23cm should give a gain of at least 15dB in a really well optimised circuit and this is the sort of gain that is needed in an average high quality installation.

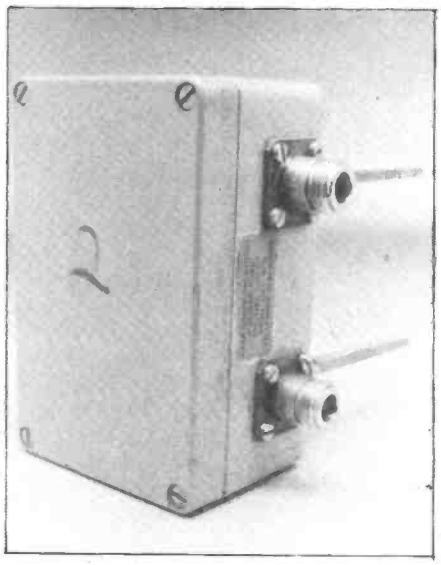
Mutek

Mutek also make some excellent products, and Chris Bartram pointed out to me that in his case, he uses negative feedback around his GaAsFET preamps to reduce distortion, and optimise gain. By doing this he claims much better input intercept points than many other manufacturers achieve with these devices. We took a brief look at one of his 2m preamps, incorporating a GaAsFET, and despite the fact that Chris explained that the device was a substandard one, which he had rejected for normal production, the 2m preamp still had a superb noise figure, slightly better than 1dB, with the gain well optimised at 13.5dB, and with an RF input intercept point as high as +7dBm, 27dB better than that of the Dresslers, which perhaps puts matters into perspective.

My own 70MHz/28MHz transverter, after we put in a new front end, and after careful adjustment, had a slightly worse noise figure than the 2m version, although very good for the purpose, as you don't really need any better on this band. Putting the very hot preamp in front makes almost no improvement, which is what matters. The gain is exactly right. I would have liked a higher Q coupling between the front end and the mixer though. Even so, the transverter works very well, although I do get one or two sproggs coming in, developed by local oscillator harmonics beating with out of band signals. The MM transverters are normally supplied with BNCs for the low levels, and either BNC, SO239 or N type sockets (dependent on frequency) for the transmit outputs.



Several of their transverters can be supplied with any of these sockets to order. My MMT144/28 transverter was supplied, surprisingly, with SO'239S but this did not seem to affect its excellent overall performance. The noise figure is very good for a transverter, and the gain is only slightly on the high side. Although I am not reviewing the transmit side, it is worth mentioning that this recently acquired model is very clean indeed on transmit, particularly at lower levels, and my Dressler linear only requires 1.5W for full output, a combination which is clean. MM use a 5-pin DIN socket for 13V DC, and PTT operation, changeover being instantaneous. These transverters are normally wired up such that the TX output socket is normally also RX input, but a separate socket is fitted, but not wired up, in case you want to separate TX from RX. The 28 MHz IF input is also the receive output in RF sensed models, a separate output being available in parallel with the receive converter output. All the MM products are supplied in diecast boxes, and are very easy to install.



The MMT432/28 MHz transverter has an acceptable noise figure for the band, but you will need a masthead preamp to obtain a significant improvement in the system noise, particularly if you have much cable loss. The input to output gain on RX is in my opinion, too high, and I would have much preferred some 10dB less mixer gain, which could improve RFIM performance. As it stands, I usually switch in a 20dB attenuator on my receiver. We had a quick look at an SSB Products 432/144MHz transverter which was amazingly compact, again with BNCs throughout. The noise figure was better than that of the MM, and the gain somewhat less, which is welcome, but note that the TX output power is very limited. SSB Products can supply small transistor linears to work with the transverter to establish typical power levels necessary to drive high power linears.

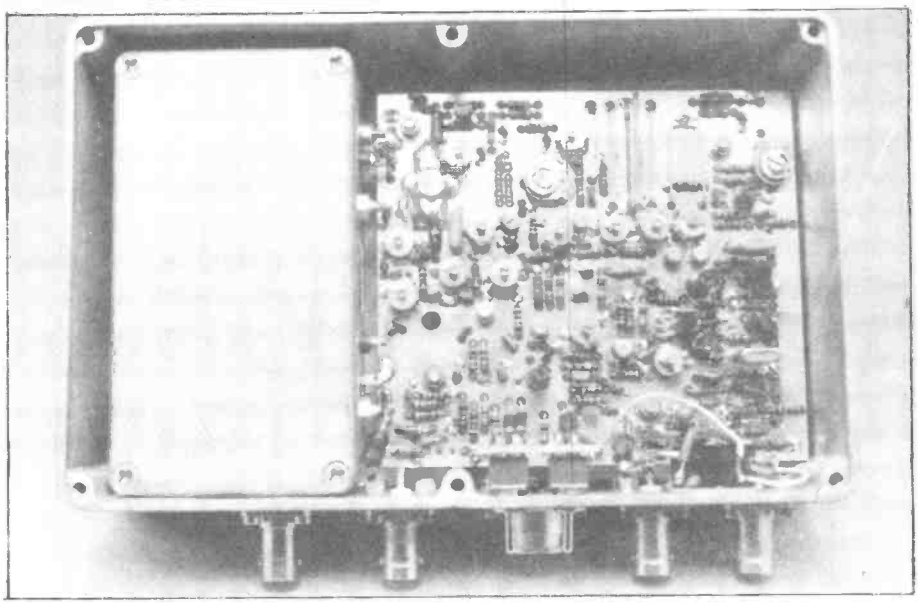
We had a look at a Microwave Modules TV RX converter from 435 to 600 MHz. This had an extremely good noise figure for a converter, but once more the gain was very high, presumably designed to work with even the deafest of TV sets! I have used this for amateur television, and it has worked very well, although of course you can't use it properly for monitoring your own transmissions, as the input blocks with a very high leakage power. This is one of those problems which will beset almost any TV converter though, and the best way to monitor is to sniff and rectify the transmitted waveform and feed the results to a proper video input monitor.

Microwave Modules Transverters

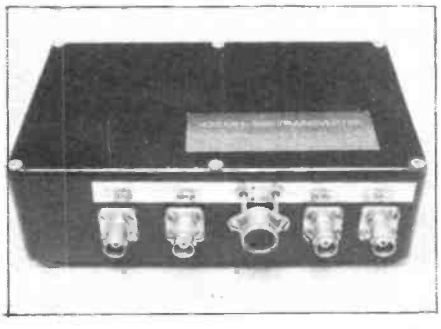
I am still using a very early MM1296/144MHz transverter, which has always worked extremely well. Its noise figure, though, measured out rather poor, and the overall gain is almost astronomical, since most users would use it with a power attenuator/black box combination. I would have preferred very much lower gain though, as would those who take the band seriously by using masthead preamps. Perhaps MM should make a model with much lower gain when external preamps are in use to improve RFIM. Very recently, the manufacturers have updated this model in two significant ways; the transmit output power is now specified as at least 2W instead of around 1.25W, and the receive section now incorporated a GaAsFET. MM specify the overall transverter RX noise figure as better than 2dB, which would be really excellent. I believe the gain is still in the same ballpark though, which might be unfortunate. It is only fair to point out that you will need the gain if you put the transverter itself at the masthead, being content with 2W at the antenna, with an average downlead, power attenuator and average black box, with its inevitable poor noise figure. I highly recommend this transverter on a band which is rapidly gaining popularity.

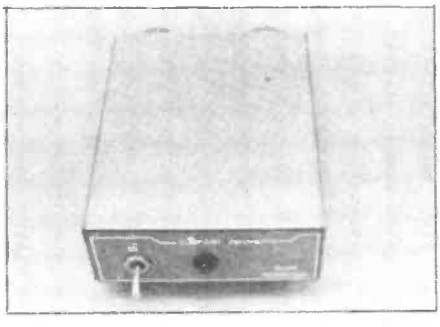
Conclusions

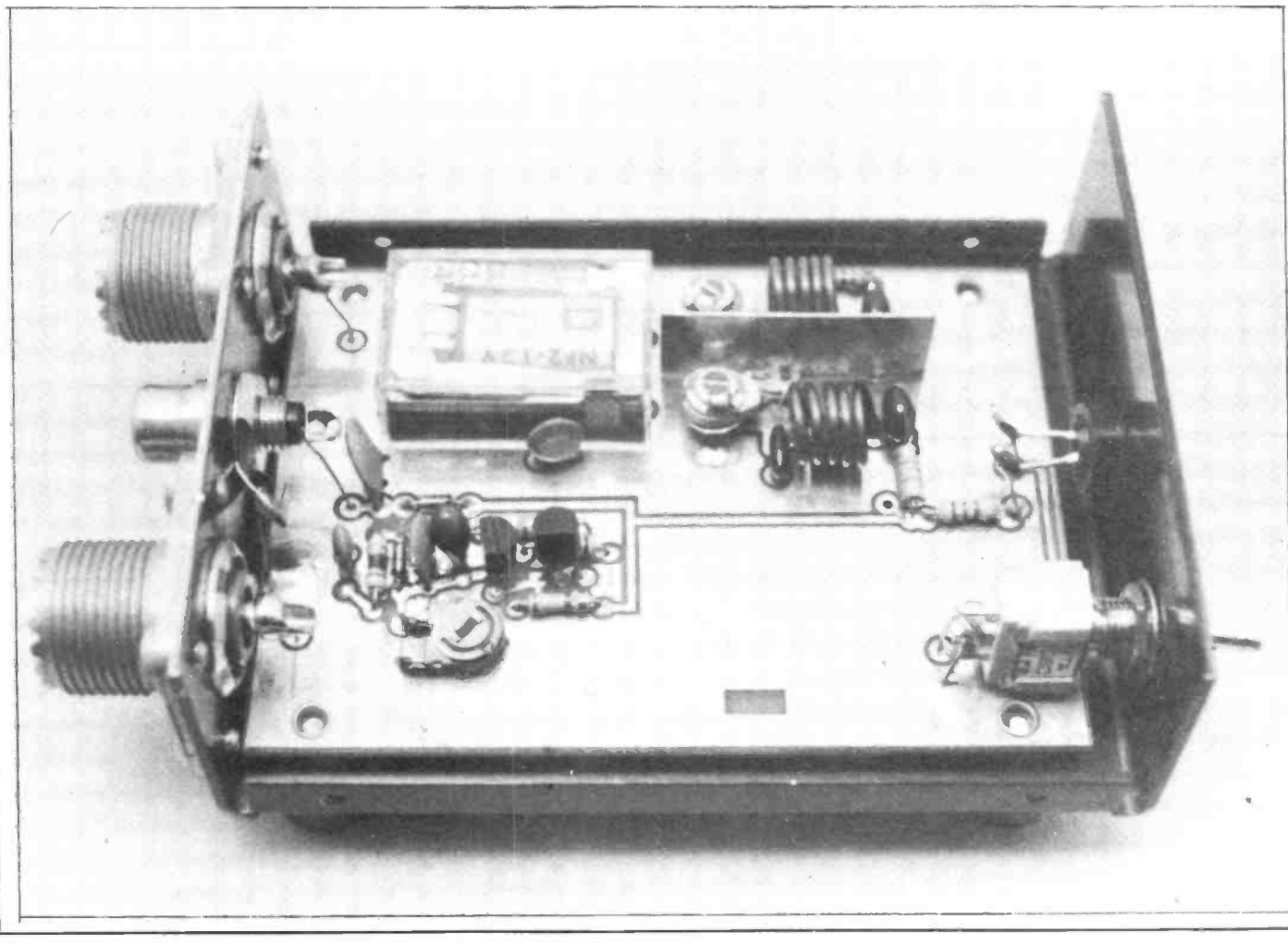
I hope you will understand that I have put in many products that I have only had time to measure briefly for the listed parameters, as this bulk review is intended to show the importance of gain and noise figure in the context of various band operations. A few of the models may not be available new, but are frequently advertised secondhand, and so I hope you will find all the comments helpful. Perhaps the most important point of all about this survey, is that you should have a preamp which you can switch out of circuit when RFIM problems show up. I would like to thank Myles Capstick G4RCE, and Simon Roberts G8UQX who helped me with all the measurements, and SSB Products, Microwave Modules, Mutek and H. Lexton for loaning me various products, and answering so many queries on the telephone.



Above: Microwave modules 432MHz transverter. Bottom of page: Lunar preamplifier.







S·W·L

For the short wave listener

Amazing! Now we're getting answers as well as questions in the letters to this august(ish) page. Paul Kennedy, G4DVQ, sheds light on a matter we raised in the July issue about the ship-to-shore traffic on 80m. (Fishfones to you and me.)

If you remember we were wondering why the ship-to-shore stuff is on Upper Sideband (USB) whereas 80m amateurs are on LSB. Well the answer is - why not? It's just a convention that's grown and stuck. There's nothing technically special about sideband.

Paul Kennedy says that "all QRJ's within the civil maritime MF/HF bands 160m to 11m (1.6 - 25MHz) use USB, (H3E, R3E or J3E), this being a world adopted standard.

"The only LSB usage I know of, within the maritime band, is the ISB (Independent Sideband) transmission that normally takes place on the 80 metre band. The USB component again being utilised for telephony whilst the LSB component is used for RTTY.

"ISB systems are normally used by a group of oil rigs/platforms giving each rig/platform a dedicated telex channel and a shared telephony channel.

"Certainly all marine transmitters that I have worked with have only a USB (H3E, R3E or J3E) capability for QRJ's and only a few marine receivers I have used have been capable of receiving both ISB and USB"

Thanks to Tony Howard for the next letter off the pile. He comes up with a number of interesting suggestions, and none of them are in the least bit rude. "How about an affordable (i.e. around a tenner, because my gaffer is as stingy as yours) 50MHz to (say) 28MHz converter. And a 144 to 28 one for that matter."

Special request

Well, Tony, we've taken up your idea and will be printing a design for one (50 to 28MHz) probably in the next issue. What's more, there'll be ready-made printed circuit boards and kits of parts available for those who want them.

Tony has also been inspired by John Heys' series on wire aerials and has been experimenting. "The fruits of these labours should be going up in semi-permanent form soon, once I have removed the tangled mess from the rose bushes!"

Tony also has a moan about the printing mistakes. Don't we all. Hopefully that problem will be largely solved now we've got a full time editor.

An interesting letter, whose writer had better stay anonymous, grumbles that we have had "... a couple of nebulous articles of general waffle about SWLing, all very interesting, but very little help." Ouch.

Mother-in-Law's rolling pin

The writer then goes into general waffle about his days on illegal CB, and seems to be more or less frothing at the mouth near the end where he says "If I've raised the heckles of you Home Office officials and pirate haters, don't try to get me at the above address, or you'll have Mother-in-Law's rolling pin to contend with, and she's a Russian hammer thrower!"

As from next month the SWL page will be taken over by Trevor Morgan, pictured here in his shack. He has been interested in listening for over 30 years: amateur band listening started in 1973 with a DX160 receiver replacing a CR70A. A friend encouraged him to take the RAE and he is now active on HF as GW40XB, using a TS130V transceiver. He also uses 2m for local chat and transmitting RSGB slow Morse every evening.

Trevor is also keen on experimenting with aerials and still listens with a Sony ICF67OOW. He's a member of the RSGB, active with the Worked All Britain group, and he's a local representative of RAIBC.

As if that isn't enough, Trevor is a member of the G-QRP Club and a founder member of the Swansea Radio Amateur Constructors' Club.

Busy little bee isn't he?

South Midlands

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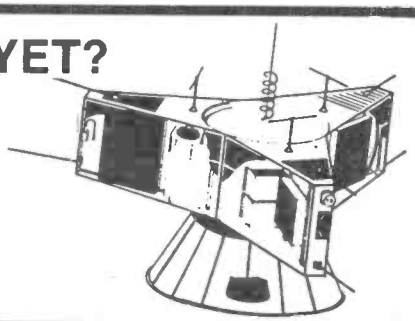

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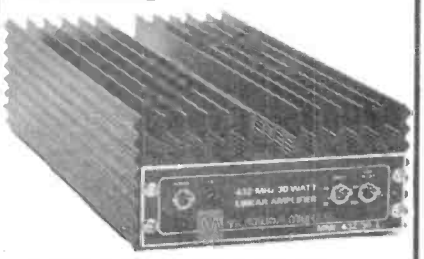
MML432/30-L



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160m for next to nothing

If your receiver doesn't cover the 1.8MHz band then this homebrew converter by Rev. George Dobbs could be just the job.

The 1.8 to 2.0MHz Amateur band (160 metres) fondly called "top band" or "one sixty" by its faithful inhabitants might also be called "the forgotten band".

In the 1960s it began to disappear from the bandswitches of commercial equipment and a good many transceivers and amateur band receivers do not include the band. There it sits, just off the end of the medium wave spectrum, under-used by amateurs in general but beloved by its devotees.

In many ways top band is amateur radio's strongest link with its past. They were brave amateurs who ventured up onto the band, from the crowded 200 metre range, that began the march into the short wave spectrum. It's hard to believe now that most of the important engineers of the early 1900s thought that the efficiency of radio waves increased as frequency decreased.

In the 50s, top band carried most of the local amateur traffic on AM but now most of that has gone VHF. However, there is still a good collection of amateurs who enjoy the challenge of 160m. It is a band of real challenge for DX working and a friendly band for local chats both on phone and CW. In fact it has also been called "the gentleman's band".

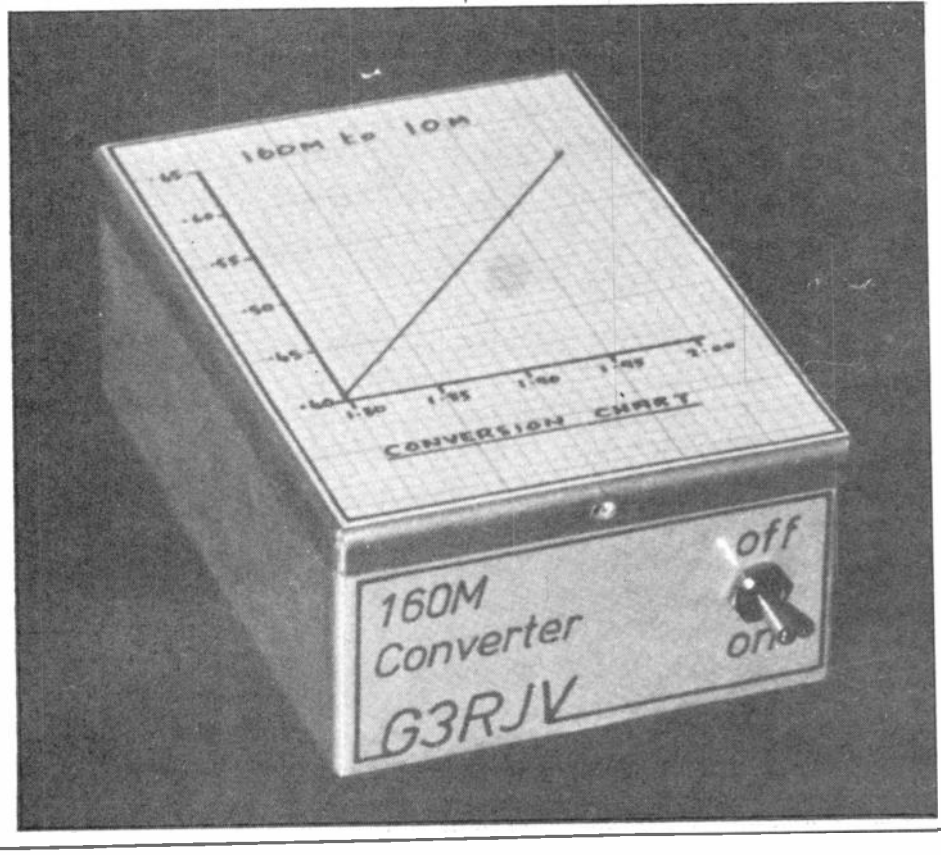
Not got it on your transceiver or receiver? Never mind; here's a simple little circuit that will at least enable you to receive the band. This is a simple receiver converter that can be built very cheaply or from junk.

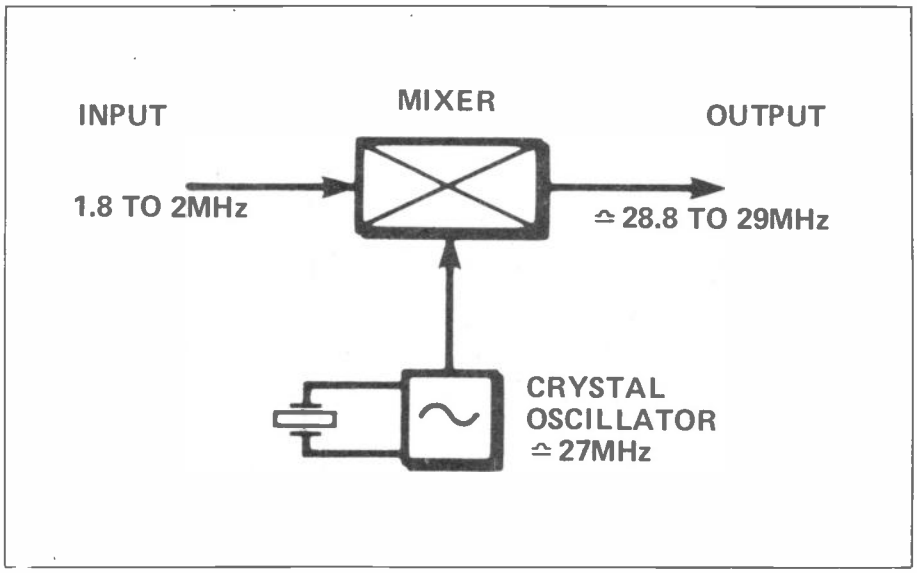
Block diagram

Fig 1 shows a block diagram of the converter. The problem is that we wish to receive 1.8 to 2.0MHz on an existing five-band transceiver (80-10m) or a receiver. Converters work by mixing the incoming signal with an oscillator so that the output comes out at a required frequency. Several frequency conversions could be used but this converter changes the 160m signals into 10m (28-30MHz) band signals. There are good reasons for this which I will explain after we have seen the principle of the circuit described in Fig 1. The input signal (1.8 to 2.0MHz) is fed into a mixer and here it is mixed with a signal provided by an internal oscillator.

I have taken a nominal 27MHz as the frequency of the oscillator. The output from the mixer will contain the original signal, the oscillator signal, the sum of the original and oscillator signals and the **difference** between the original and oscillator signals. Taking the sum of the two signals this would give us at 1.8MHz (1.8 + 27) an output of 28.8MHz and at 2.0MHz (2.0 + 27) an output of 29.0MHz. This is a range in the 10m amateur band and if we tune this signal out, we have converted the 160m signal into a 10m signal. Feed the output into a receiver tuning the 10m band and we will hear top band.

But what a conversion? We have moved from the lowest frequency HF band to the highest frequency HF band. But that is not a bad thing. Up conversion to a high frequency is all the rage these days. The high output frequency helps to overcome images appearing on the signal and prevents IF breakthrough. Also, those who know both bands will tell you that when 160m is up, 10m is dead and vice versa. The additional important advantage is that crystals which will produce a stable oscillator signal around 27MHz are easy to get hold of at low cost. I used this converter ahead of my Argonaut 515 QRP transceiver and the performance was surprising for what is, after all, a box.





Circuit diagram

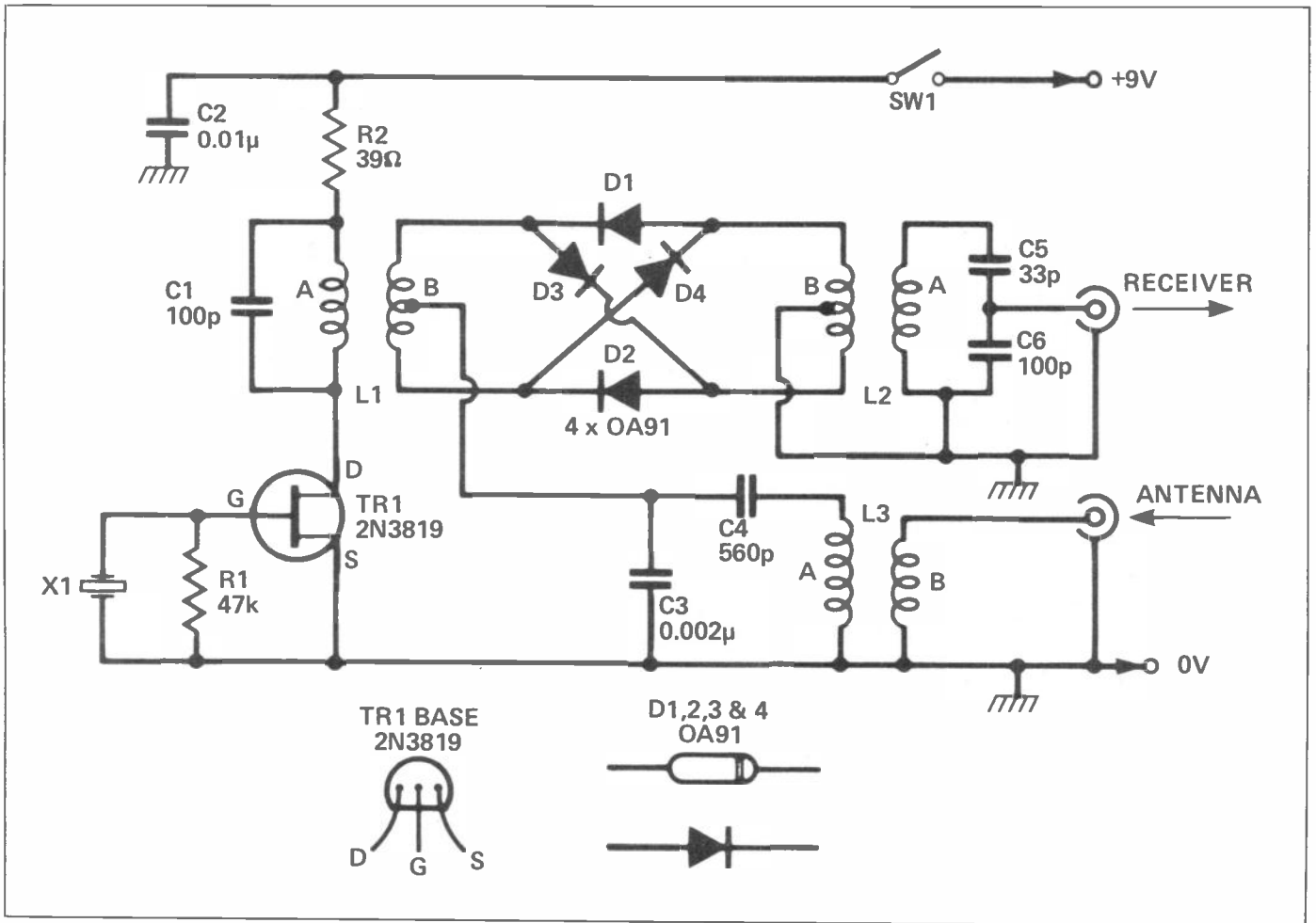
The circuit for the converter is shown in Fig 2. The input on 160m is fed into a tuned circuit, L3, then into a passive mixer circuit. The oscillator is a single FET, TR1, oscillator controlled by a crystal X. Usually crystals marked for around 27MHz work on their third overtone; that is, they oscillate at a third of the marked frequency, so the output is tuned by L1A and C1 to the required frequency. L1A and C1 also form part of the mixer input circuit. The mixer is a passive circuit using four germanium diodes. OA81s were used in the prototype but almost any similar diodes would serve.

The four diodes form a mixing bridge across two tuned circuits with link windings. The incoming top band signals are injected into the mixer on the centre tap of L1B and the mixed output is coupled via L2B and L2A which tunes out the 10m component.

The crystal X can be had from a variety of inexpensive sources or even picked up for nothing. I used a crystal from a broken toy car radio control transmitter. Another source is that mountain of broken or unused illegal 27MHz walkie talkies - the type with squeaking regenerative receivers and one crystal in the box. 27MHz radio control equipment will also yield useful crystals and these can be bought at reasonable prices as replacement crystals if no surplus equipment is at hand. The only requirement for the crystal is that its frequency is such that when 1.8 to 2.0 is added the sum comes out on a tunable portion of the 28 to 29MHz amateur band. Rather than be tempted to buy a model control crystal look around for junk sources. Apart from being cheaper, this is what the spirit of amateur construction is about.

Fig 3 and the photographs show the method of construction. Essentially it is all built around the three coil formers for L1,2 and 3. The prototype was built in an aluminium box some 4in x 3in x 1½in. The circuitry fits nicely into this size but almost any box could be used, the only actual requirement being that it is metal, for screening, and the components fit into the space. The box will require a switch for on-off and two sockets for 1.8MHz in an 28MHz out. The power supply is from an internal nine-volt battery, so leave room for a PP3 battery or a similar nine-volt source. The current drain is so small that even a PP3 should last for years.

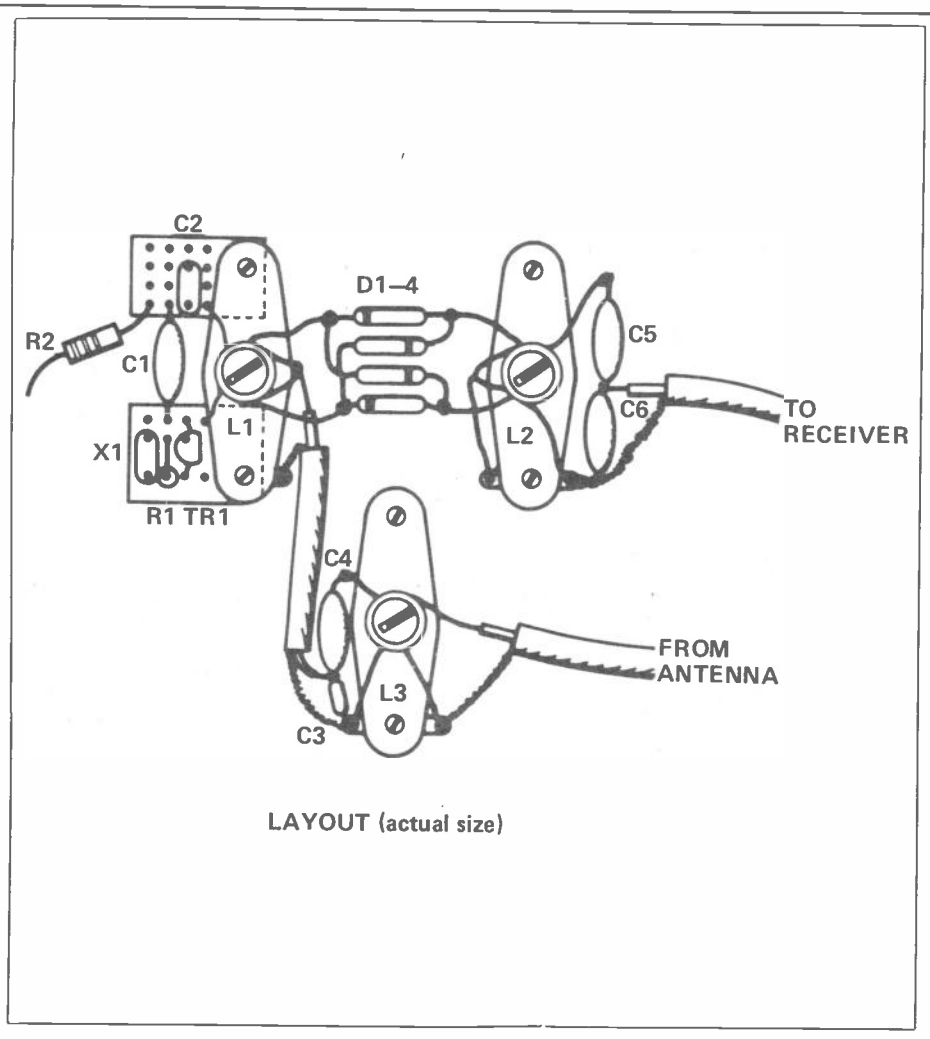
Left: completed converter mounted in an aluminium box. The graph on the lid is for checking the converter's input frequency. Above: block diagram (fig 1). Below: circuit diagram (fig 2)



160m for next to nothing

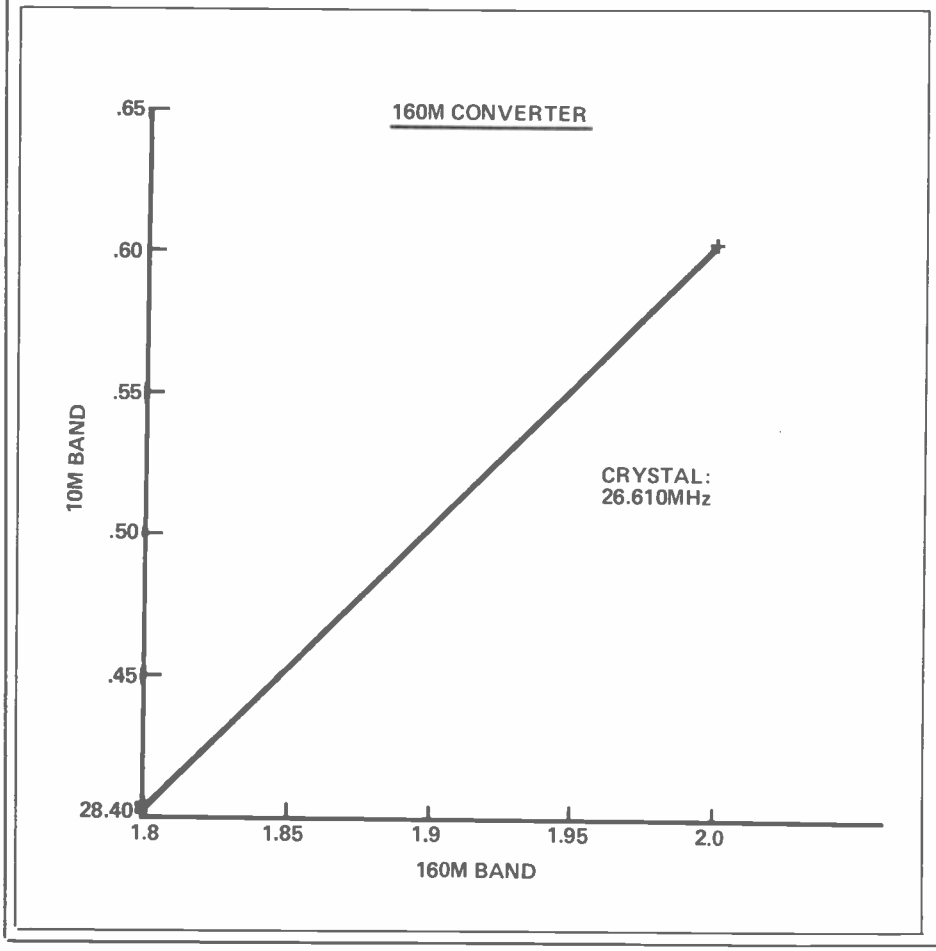
The first stage is to wind the coils which are on $3^3/_4$in outer diameter formers (10mm) and wound with enamelled copper wire. The wire gauge is given but it is not very critical. I rarely use commercial reels of enamelled wire and most of my coil winding is done with wire from old transformers and coils. If the wire looks about the right gauge, on it goes. 22swg is about the gauge used for the single conductor or PVC covered hookup wire used by many amateurs; in fact this PVC covered wire could be used for L1B and L2B. 32swg is thin stuff (to be exact 0.08108 inches in diameter) but an easy way to check is to see if you can get out 35 to 40 turns on a former to give a winding half an inch long. 22swg, without a PVC covering should take about 16 turns for an half inch winding as a rough guide.

The wiring layout is shown in Fig 3. The capacitors associated with L2 and L3 are directly wired around these coils with screened wire being used to take the input and outputs to and from the coils and the signal from L3 to L1. The only slightly complicated wiring is of the oscillator circuit around the coil, L1. For this I used scraps of veroboard which are mounted under the two fixing bolts for the L1 coil former. These require stand off pillars beneath the pieces of veroboard to hold them away from the bottom of the case.



LAYOUT (actual size)

Above: wiring layout (fig 3A). Below: frequency conversion graph, Fig 4.



The coil formers are attached to the bottom of the case with 6BA nuts and bolts. The standoffs are only required for L1 in conjunction with the veroboard but all three formers have 6BA solder tags which are used as grounding points for the circuit.

The circuit layout for the oscillator is shown in Fig 3. The underside is also shown as a guide to the required solder connections and breaks in the copper strips in the Veroboard. These breaks are made with either a spotface cutter (expensive) or the point of a small twist drill. The crystal should be of the HC25U type mounting which fits directly into the Veroboard spacings. If a larger type of crystal is used, leads will be required from the board to the crystal base. The resistor, R2, is a "free flying" component which goes to the switch, then to the nine volt supply.

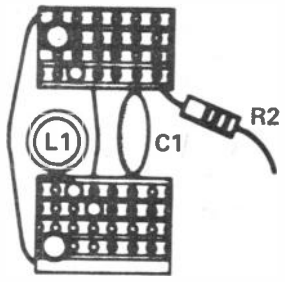
Setting up

The converter can be set up without any test equipment by simply trying it out and peaking the results on the coils. However it is helpful to set up the oscillator coil first by using a simple diode probe and meter on the output of the oscillator, L1B, before the rest of the circuit is wired in place. Tune the core of the coil for a peak in the output on the meter. If a signal

= SOLDER CONNECTION

= BREAK IN TRACK

= METAL STANDOFF



UNDERSIDE OF BOARDS AROUND L1

Above: fig 3B.

Right: components list.

Table 1 Components List

R1 47K
R2 39R
C1 100p mica
C2 0.01u min.disc
C3 0.002u min.disc
C4 560p mica
C5 33p mica
C6 loop mica

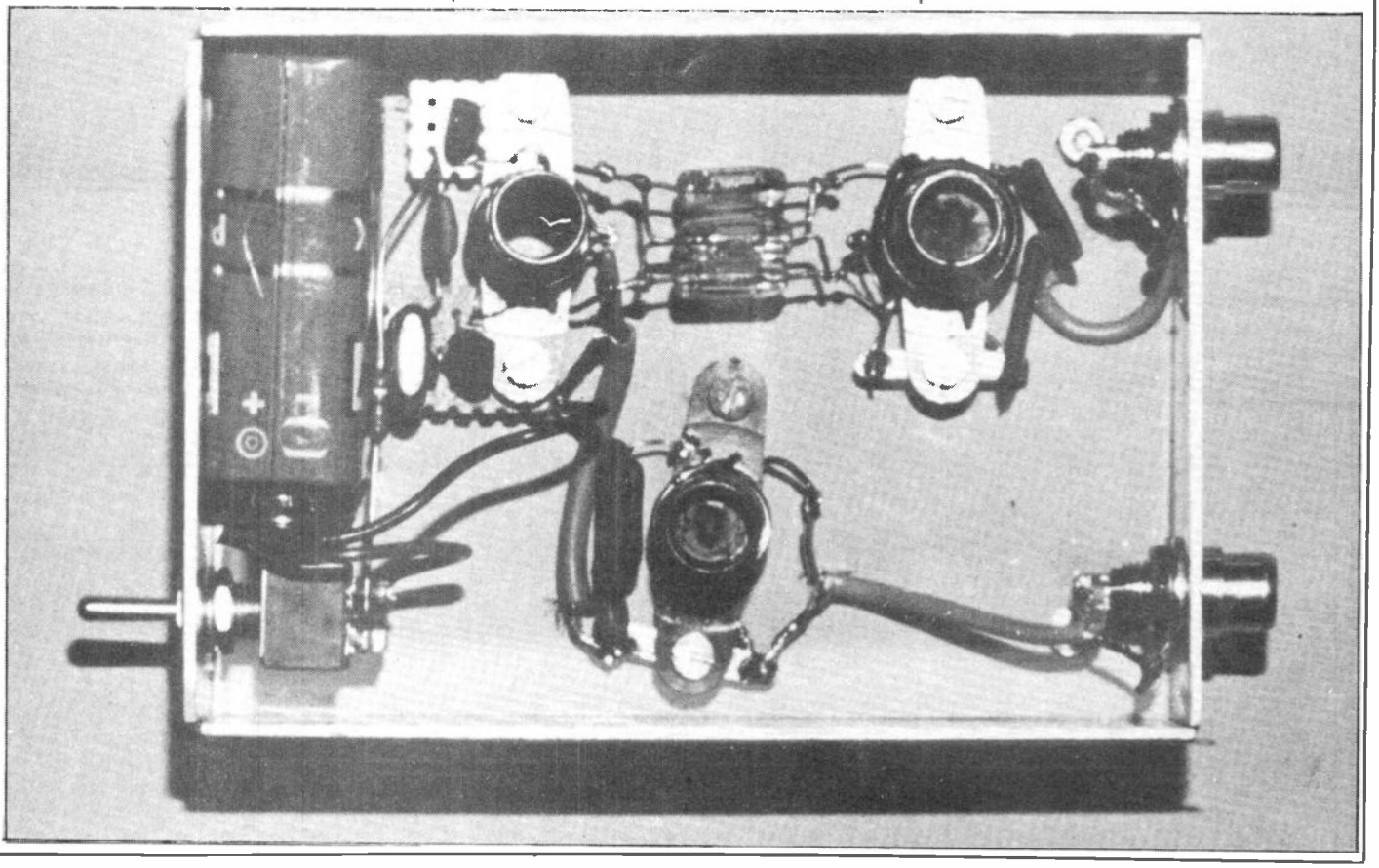
TR1 2N3819
D 1 to 4 OA81
X crystal (see text)
S1 miniature toggle on/off
2 sockets
aluminium box approx 100x75x40mm
PP3 snap connector
screened wire

L1A 13 turns 32 swg
L1B 2 turns 22 swg centre tapped over L1A
L2A 8 turns 22 swg
L2B 2 turns 22 swg centre tapped over L2A
L3A 33 turns 32 swg
L3B 5 turns 22 swg over base of L3A
all coils wound on 10mm formers with cores
all wire enamelled copper
(L1B and L2B could be PVC covered)

generator is available, it can be used to set up L2 and L3. Tuning up by using signals on the band is quite simple. Do it in the evening when there are available loud signals on top band. The band has several convenient (except when you are operating on it!) jingle bell type signals that can be used to peak the cores of L3 and during evenings there should be little on the 10m band which can be peaked up by mistake for top band signals. But just in case, check that the signals being peaked up are on top band by switching off the converter and seeing if they disappear.

It is helpful to know what readings on the receiver dial correspond to frequencies on top band so a graph may be drawn as a tuning guide. Fig 4 shows the graph I used for the prototype. This used a crystal of 26.610MHz and the graph is just a straight line affair using the CRYSTAL FREQ + 1.8MHz and CRYSTAL FREQ + 2.00MHz to give the two fixed points for the line. I pasted the graph onto the top of the box lid for ease of reading.

This little converter, although simple, does perform well and can give good reception on top band for those without 160 on an amateur bands receiver or transceiver. And it has the advantage of costing next to nothing, and being easy to build.



By Glen Ross, G8MWR

News and topics of interest for the bands above 50MHz

So what's new?

First let's take a look at the repeater scene and more especially at what is happening in the Cambridge area by the Pye group.

Chris Lorek (G4HCL) sent us some details of what is currently being done on the group of repeaters which they look after. Let's start on two metres and Britain's oldest repeater, GB3PI. This was first licensed for an experimental period to check the feasibility of repeater operating in this country. The repeater was originally located in Cambridge but some years ago it was moved to the present site near Barkway, where it has been giving excellent service. The ravages of time and weather have taken a toll on the system, particularly on the co-ax. This is now being taken down and replaced with Heliax; at the same time the system is being changed to single aerial working. The hoped for result is a 3dB gain in receive capability. This would also bring about a similar increase of unwanted interference from stations using other repeaters which may in fact cause more problems that it solves. It may well be that the time has arrived for everyone to have a rethink as to what is really needed from a repeater, certainly trying to achieve an 'All England Repeater' is not the way to go. Perhaps we should take a good look at the USA system where there are many more repeaters in a given area and yet mutual interference problems hardly exist. As an example of the repeater coverage there, I could get into seven repeaters from a hotel room in Washington DC using an IC2E on its helical aerial! An interesting unit was the one located at Tyson's Corner about ten miles out of the town. They discovered that many people using handhelds in the town were not getting into the repeater. They installed a second receiver on a building not a million miles from the White House and installed a microwave link to the main repeater site. The repeater then checks the level from the two inputs and uses the strongest one. Perhaps we should be campaigning for those sort of facilities here.

Let's get back to the main point and move on to GB3PY on RB14 which at present is located at Madingley. This unit will shortly be moving to a site in Cambridge. Site tests have indicated that this will give superb results around the city and it is perhaps time to dig out those old Pocketphones again.

An 'All England Repeater' is not the way to go

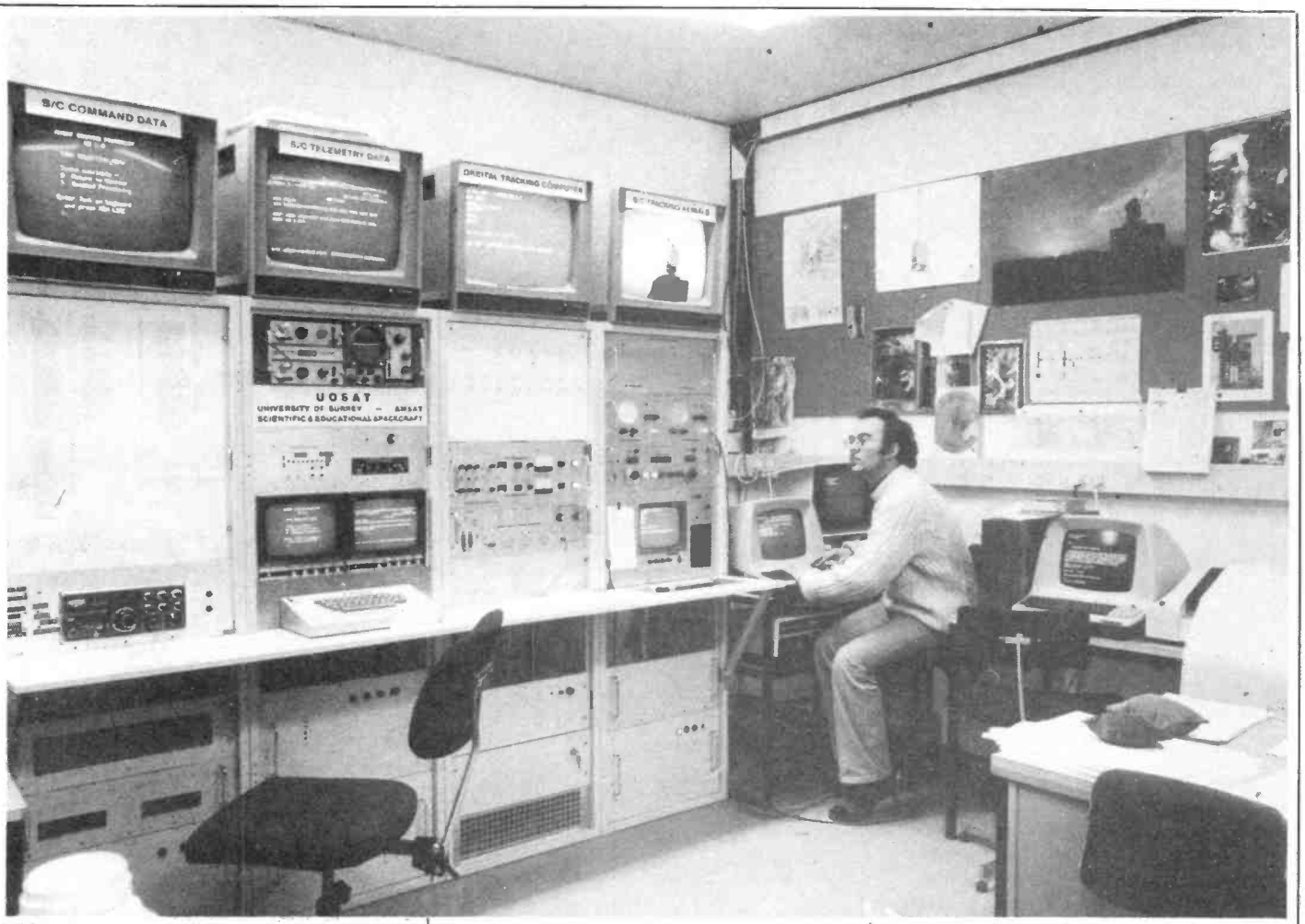
Next on our list is GB3PT located at Barkway and on RB12. Moves are under way to add data relaying facilities to this one, which should be good news to the computer enthusiasts in the area. This will be combined with a message store so forming an 'electronic mailbox' facility. Standard European CCITT telephone modem frequencies will be used at 300 Bauds. This will suit the Sinclair users and will only involve a simple converter for those requiring different speeds. There is no truth in the rumour that access to this repeater will only be obtained after zapping ten Klingons!

The last one on the list is GB3PS on RM3 (1291.075 in, 1297.075 out), also located at Barkway. In common with all the 23cm repeaters this runs in beacon mode until it receives a toneburst, when it switches to repeater mode. The clever trick on this unit is that it is fitted with a 'Digitalker' and if you are off frequency or over deviated it will come back and tell you all about it. When finally installed it will use a pair of slot aerials fed with LDF 550 Heliax, and will run horizontal polarization.

Thanks to Chris for all the information. If you need more he can be contacted on 0354 740672. He will also be pleased to tell you where you can send your subscriptions. We would like to hear from other groups as to what they are doing.

All over the place

That is what you achieve if you are using a Slim Jim or some other omnidirectional aerial, but if you use a beam of some sort then the whole picture changes. Now you are squirting your RF in only one direction and several things are worth thinking about. First, when you are calling CQ remember that your chances of getting a reply are much greater if you say where you are located. This gives the other fellow a chance to get his aerial on to you without having to go all the way round the clock. Remember when he finds a peak he can't be sure that you are not off the back of the beam or on a side lobe. It's also a good idea to say which way you are beaming. If someone is only getting a very weak signal from you but knows that he is off the side of your beam then it is still worth calling you because signals will come up once you turn your beam. For the same reasons it makes sense to give the same information when you reply to a CQ call. These things are of course very obvious when you think about it but there are a lot of newcomers to the band who are not getting the best results possible because they neglect or are not aware of these points.



Above: the Oscar ground command station control room at the University of Surrey. (Photo: AMSAT-UK)

While we are on the subject of common sense let's have a look at the S meter. Now we all know that this measures the strength of the incoming signal and therefore if there is no reading on the meter there can't be any signal. I have actually been given a report of "Q5 and S0 here OM" How ridiculous can you get? If I really was S0 then he could not have heard me, let alone give me Q5. What went wrong? Only a slavish belief in S-meters! Let's get it straight, they are only an indicator of comparative signal strength not a calibrated test instrument. (On a single band machine they could be calibrated properly but somehow the makers do not seem to bother and it would probably add at least 50p to the cost of the gear). On the very popular FT290 for instance you will not get an indication on the meter until a signal is about S5 and by the time it is around a genuiune S9 the meter will be on the end stop. The simple answer is to use your ears and not the meter, after all it is what you hear that matters, not what a meter indicates.

All information direct to:
Glen Ross G8MWR,
81 Ringwood Highway,
Coventry.
Telephone: 0203 616941.

So what is the meter useful for? Simply giving comparitive reports. If your mate has been playing with a new aerial it is useful to let him know whether it is an improvement or not and a look at the meter will tell you if the signal is up or down on what it was before. Do not fall into the trap that you hear so often when people are trying out a new linear of saying "Well you were S3 and now you are 10dB over S9" when he increases the power from 10 watts to 100. Think about it. That is an increase of only 10dB. The great god S-meter fails again!

There is a growing interest in using amateur TV on 10GHz. So far we have not heard very much as to what sort of results are being obtained. G3KEU (Tim Swindon) is known to be active on this mode and is able to send full colour pictures. He tells us that he has managed contacts of 16km with noise free pictures. Presumably this was achieved using about 10 milliwatts to the dish. We do not have any details of the modulator etc., but these should be available from Tim who, of course, is anxious to get other people on to the mode. If anyone else has got a system running would they let us know? The interest in microwaves is growing very rapidly. The Microwave Society 'Datapack' on building and operating an FM system has now sold over 300 copies since it was first introduced at the RSGB NEC Convention in March. How about exchanging computer programs across town?

Sporadic-E

The opinion on this year's sporadic-E season seems to be that it was just that. The degree of 'sporadicity' seemed to depend more on the part of the Country that you live in than anything else! Some really excellent contacts have been achieved but the general impression seems to be that it has not been an outstanding season. As you know we do not intend to get involved in long lists of who worked what (and judging by the postbag most of you agree) but we will try and sort out a summary of the major events so that you can form your own conclusions. One thing is certain, you do not need to run large amounts of power to work this mode. It may help, but being in the right place at the right time is far more likely to bring results than trying to blast your way through the pile up.

The degree of 'sporadicity' seemed to depend more on the part of the Country that you lived in than anything else!

Our man in space

The system used for 'working' the space shuttle at the end of October is certainly novel. The idea is that for a period of one minute you simply keep repeating your callsign. During the next minute our man in space then reads out a list of all the callsigns that he managed to pick out from the immense pile up. That is it! You do not get to talk to the nice man, and they call that a contact. I think I will go and lie down in a nice,darkened room and see if I can discover just why anyone should want to do that. Of course there is a special QSL card. (A certificate is available to anyone who works me at 1300 hours on any Friday the 13th). Perhaps we should bring back the Old Man of the ARRL and the infamous Woff Houng as an aid to a return to sanity. A lot of certificates are gained using 'contacts' which can best be described as nebulous, but they do normally require a certain amount of operating ability. All this one seems to need is the ability to keep shouting your call.

Rally round

The Telford Rally seems to grow every year and this must now rate as one of the season's prime events. What did we find that was new and of some interest to the VHF man? To be honest, not a lot. The only real surprise was a company displaying a new range of aerials based on the designs in the German VHF Compendium. The gain figures for these aerials are very high, considering the physical size of the arrays, and they are available for all bands up to 1296MHz. The Mutek preamp board for the FT290 was attracting a lot of interest and Pocketphones were going for 90 pence. Could be a cheap way of monitoring your local repeater?

Tailspin

So we come to the end of another edition of "On the Beam". Thanks to all those people who have contacted me with news and views. We still need a lot more information from you if this column is going to reflect your interests, so please put pen to paper and let us know what you, your club or group are doing. Until next time may your particular interest in the bands above 50 MHz provide you with a lot of pleasure and maybe a few frustrations to keep you on your toes.

There will be no set format for this feature. It will include reports of recent events, there will be news of things to come and there will also be the occasional look into any subject which might be of interest. In fact the door is wide open and the content will depend very much on the news and views we receive from you. Mind you, if you work 4X4 on 1296 we will get excited!! Any ideas will be welcomed, of course.

Glen Ross, G8MWR, first got involved with wireless in 1940 when be built an ST300 kit, (and it worked). His interest in the bands above 50 MHz can be traced back to membership of the VHF Listeners Club in 1948. He is currently active on 144, 432, 1296 MHz, and 10 GHz from his QTH in Coventry, and is well known for his talks on microwave equipment.

Below: the new Cambridge repeater GB3PS on test prior to installation. (Photo: Pye Telecommunications).

TRIODES:2

MESSAGE IN A BOTTLE

Ken Williams

Last month I dealt with the basic triode amplifier and its use at audio frequencies. Except for really high power applications, the modern semiconductor easily outclasses the valve in this service. This month I will be dealing with the triode valve as a radio frequency amplifier, at signal levels (receiver preamplifier stages etc), and at high power, and in both cases the valve can give the semiconductor a run for its money.

At high power, almost all modern commercial transmitters use valves above the 1kW level although in the next few years the situation will doubtless change. At signal levels, those of you who consider that the valve has been well and truly seen off by those little three legged fuses, please remember the "incident of the defecting Soviet fighter aircraft".

Experts who initially examined the aircraft scoffed at the radio and radar equipment, much of which used thermionic RF stages. Some time later, other experts started considering the effect of EMP (the Electromagnetic Pulse generated during a nuclear explosion) on modern equipment design and were horrified at the probable effect on solid state RF stages. The first set of experts then realised why the Soviet equipment used valves!

Remember the incident of the defecting Soviet fighter aircraft

In amateur service we are not likely to suffer EMP problems, nevertheless the problem of static is always with us to some degree or another. Under a well developed Cu-nimb cloud, static levels can be frightening. For example, some years ago, I was living in the west of Scotland and operated mainly on the LF bands using a 530ft long wire antenna. One very stormy night I accidently touched the aerial and received a severe shock. Fascinated by this, I managed to attach a VR105 neon stabiliser between aerial and earth. It immediately struck and remained illuminated for over eight hours. Few if any amateur solid state front ends could have survived this onslaught, but the old valve equipment never flinched.

The Miller Effect

The limitations of triode valves in RF circuits, and in effect the original reason for the development of multigrid valves, are due to their inability to operate at high frequencies without self oscillation unless special precautions are taken. This is a result of the Miller Effect.

To understand this, first look back at Fig. 2 accompanying last month's article which shows the basic construction of a triode valve. You will see that the grid is a coil of wire totally surrounded by a metal plate which is the anode. Due to their proximity, a capacitance exists between them. This is referred to as Cag (capacitance, anode-grid) and it acts exactly as if it did not exist, but a capacitor, value Cag, was connected between the electrodes.

Now think of a simple amplifier circuit with a resistor as the anode load (Fig. 1). If the incoming signal causes the grid to swing say one volt in the negative

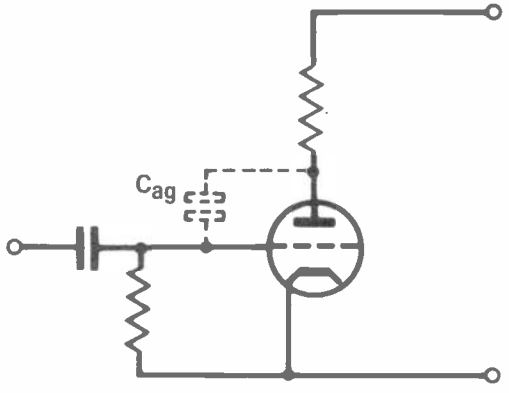


Fig 1 Capacitance exists between the grid and anode of a triode (Cag).

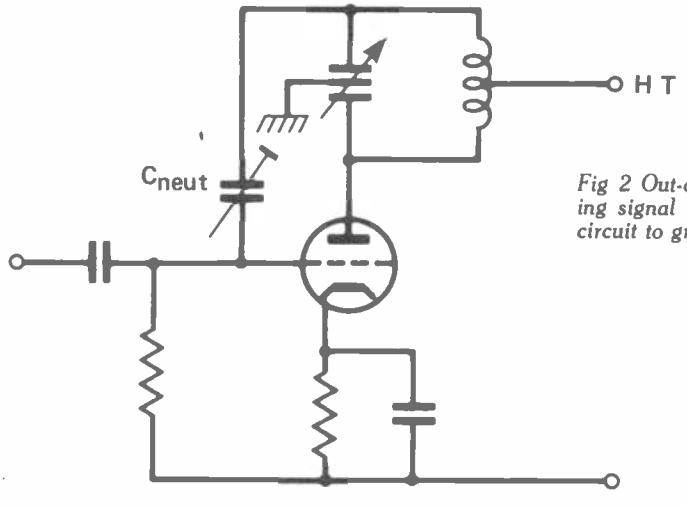


Fig 2 Out-of-phase neutralising signal is fed from anode circuit to grid.

direction, then, due to the amplification of the valve and the anode load, the anode will swing positive by perhaps 20 volts.

The voltage across the capacitance Cag is therefore 21 volts more than its static value and the current passing through it is 21 times as great as if only the grid voltage were acting upon it, and this is exactly the same as if the grid/anode capacitance were absent and a capacitor of 21 times the value of Cag was connected between grid and anode. This is the Miller Effect and is used in the Miller timebase found in many oscilloscopes.

If everything were as simple as this, the Miller Effect would be nothing but an electronic curiosity; however, as ever, things are not as simple as they seem. The instant the resistive anode load acquires some reactance (and there is no way which it will not), phase relationships start to change and the current flowing through Cag will not lead the grid voltage as in the simple case I have described. In the extreme, the effect of the reactance in the anode circuit out-see copy lossess, and the amplifier bursts into oscillation. Even before this level is reached, the amplifier will become very unstable and (if in linear amplifier service) will radiate a very wide signal.

Due to the relatively low capacitances involved (Cag is typically 1-3pF). the Miller Effect can be ignored in audio frequency applications. At RF, however, techniques have to be applied to render the effect harmless.

There are three basic methods of doing this: 1. Neutralising the grid anode capacitive feedback by feeding back a further out-of-phase signal; 2. Increasing the grid circuit losses until oscillation cannot occur; 3. Screening the input voltage from the output by earthing the grid. All these methods are effective but each has advantages and disadvantages. It is these which decide the most suitable method to use in any given situation.

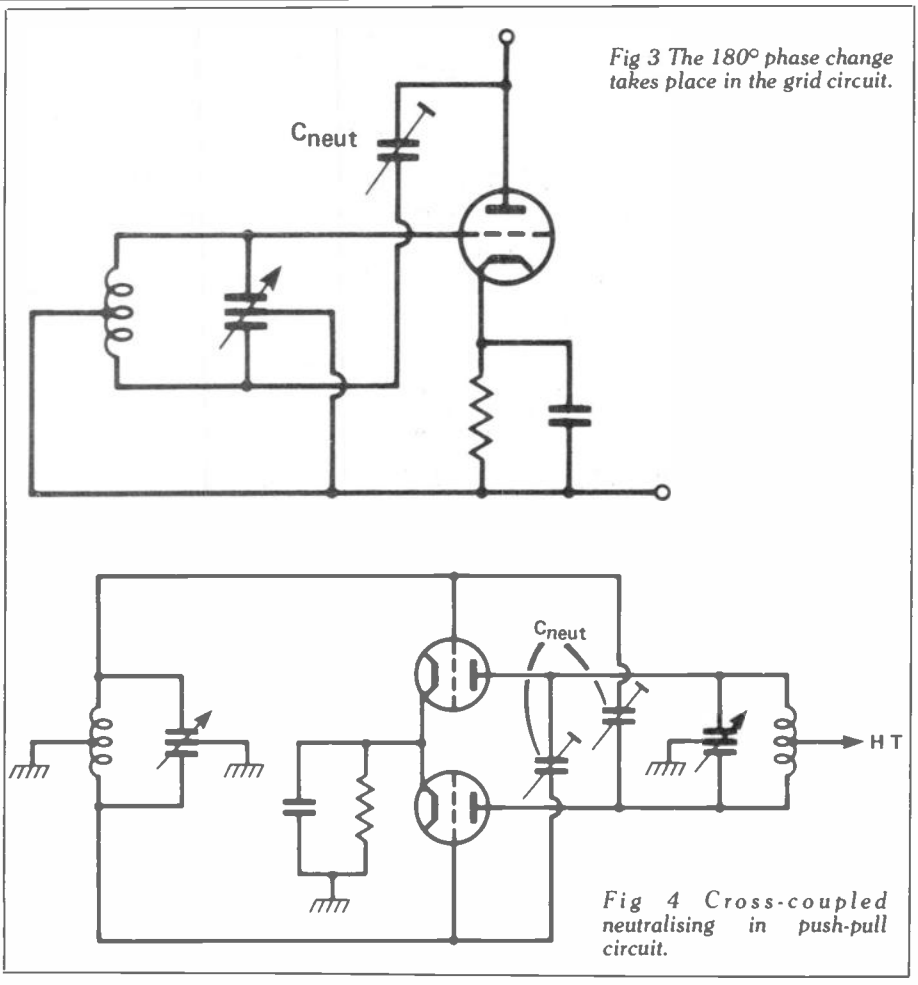


Fig 3 The 180° phase change takes place in the grid circuit.

Fig 4 Cross-coupled neutralising in push-pull circuit.

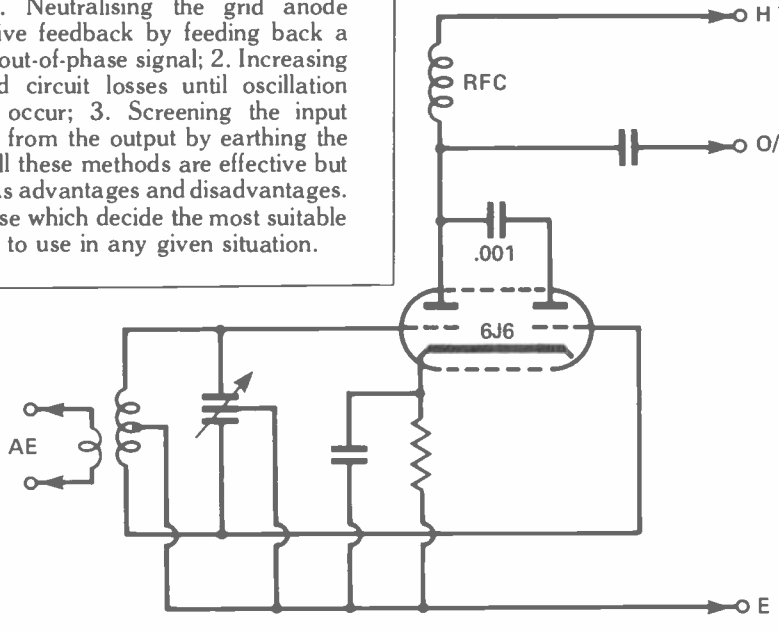


Fig 5 Neutralising circuit used for 6J6 double triode.

RF Signal Amplifiers

Just how good are triode signal amplifiers? Well, like the little girl in the nursery rhyme, when they are good they are very, very good and when they are bad they are (expletive deleted) terrible. The art lies in picking the right place to use them.

Comparing first with a pentode RF stage in a receiver with reference to gain and sensitivity, they will show no real advantage below 20MHz but above this frequency they will start to come into their own. At 30MHz it will be a good pentode stage that is noticeably better than a triode and by four metres and above, the difference is enough for the pentode to drop out of consideration. Specially-designed triodes are capable of giving quite useful performance right up to the 23cm band.

Comparing now with transistors, we have to look at other parameters: mainly noise and cross modulation. In general, their gains are on a par, with perhaps the transistor having a slight edge. However, almost any valve correctly operated will show better cross modulation characteristics than a transistor.

This alone gives a valve a head start across the HF band where the superior noise characteristics of the transistor are masked by the incoming atmospheric noise. With the decrease in noise from this source with increasing frequency, as the VHF bands are approached, it rapidly becomes a case of 'no contest'.

It is not always realised how much other factors such as the material used for the PCB can make to the final noise performance. Some years ago I needed a 4m converter in a hurry so for convenience I used Veroboard for the PCB. Try as I may, I could not obtain a noise figure better than 7-8dB. In desperation I finally stripped the board and rebuilt the circuit on high quality fibreglass. The noise factor immediately improved to better than 2dB.

Neutralised Triode

The first technique which can be used to overcome The Miller Effect is to apply a feedback, exactly 180° out of phase and of equal amplitude to that, via Cag, the cause of the problem. This requires either the grid or anode circuit to be tuned to the incoming signal. It is a characteristic that there is a phase change of 180° across a parallel tuned circuit, therefore if (as in Fig. 2) a small variable capacitor be connected between the opposite end of the tuned circuit to the anode and the grid, a controlled amount of feedback can be applied.

The reason for the HT centre feed to the coil is that the HT is effectively an earth to RF, thus without moving the feed point there would be no RF to feedback! A split stator capacitor is used so that its shaft is isolated from the HT voltage.

Equally effectively, the feedback can be applied directly from the anode to a point of 180° out of phase with the grid voltage as in Fig. 3. Fig. 4 shows the neutralisation of a push-pull stage.

This neutralisation technique is very effective and can be used either in a signal amplifier in receivers or in high power RF output stages, the only variation being the method of adjustment.

To adjust an RF power amplifier, first disconnect the HT voltage and apply drive to the grid. Set the neutralising capacitor to minimum and monitor the grid current. Rock the tuning capacitor backward and forwards through resonance and watch the change in grid current. Gradually increase the value of the neutralising capacitor until the change is a minimum. Reconnect the HT and check that the stage remains stable. If necessary, make a slight adjustment to optimise but REMEMBER TO SWITCH OFF THE HT BEFORE EACH ADJUSTMENT, as HT is on one side of the neutralising capacitor.

In the case of a receiver RF stage, tune to a strong signal or a signal generator. Disconnect the HT to the triode and adjust the neutralising capacitor for minimum signal. Reconnect the HT. If a noise is available make the final adjustment for best noise figure.

Some years ago, an interesting little circuit was published for a 6J6 double triode (Fig 5). In this, the grid-anode capacitance of the second part of the valve was used as the neutralising capacitor for the first half. The circuit never really caught on although the

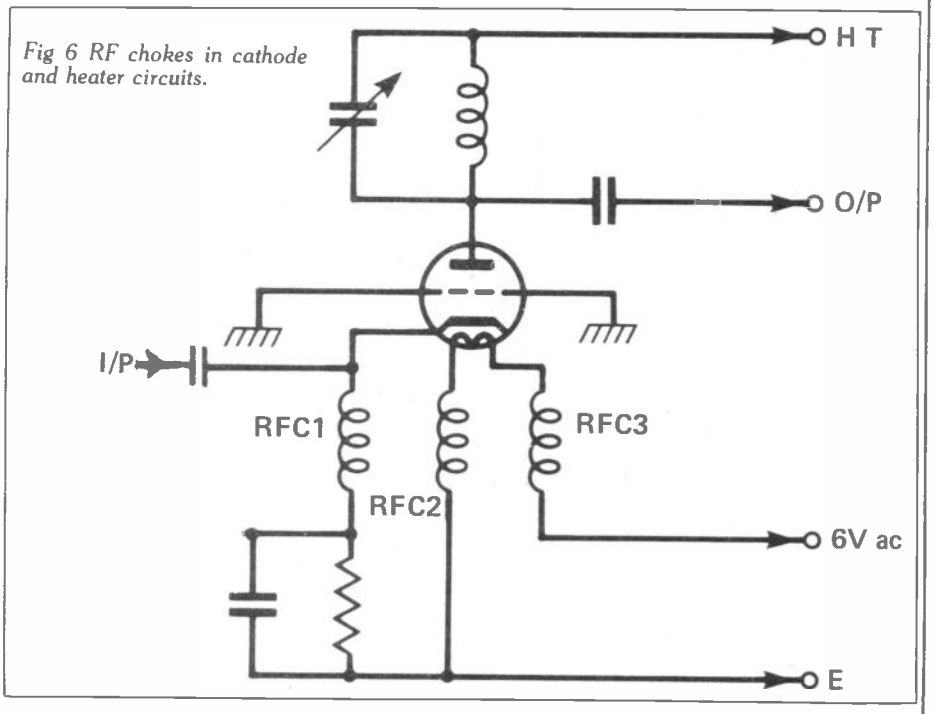


Fig 6 RF chokes in cathode and heater circuits.

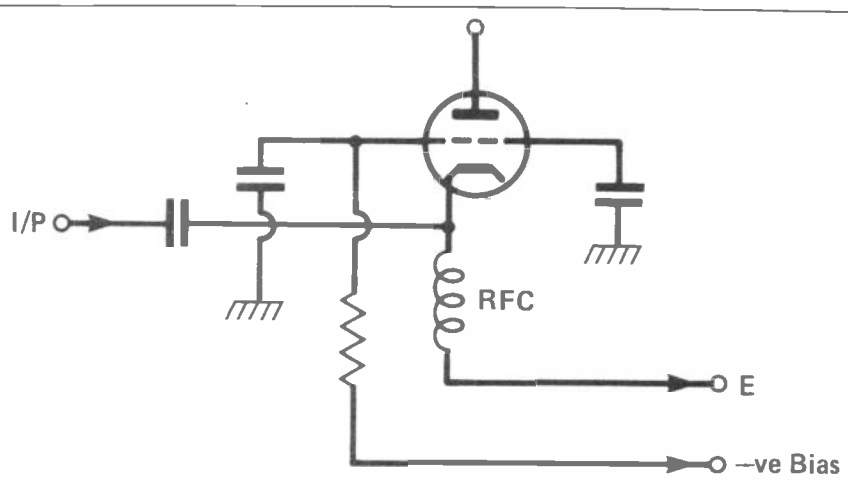


Fig 7 Grid is grounded as far as RF is concerned, but DC bias can still be applied.

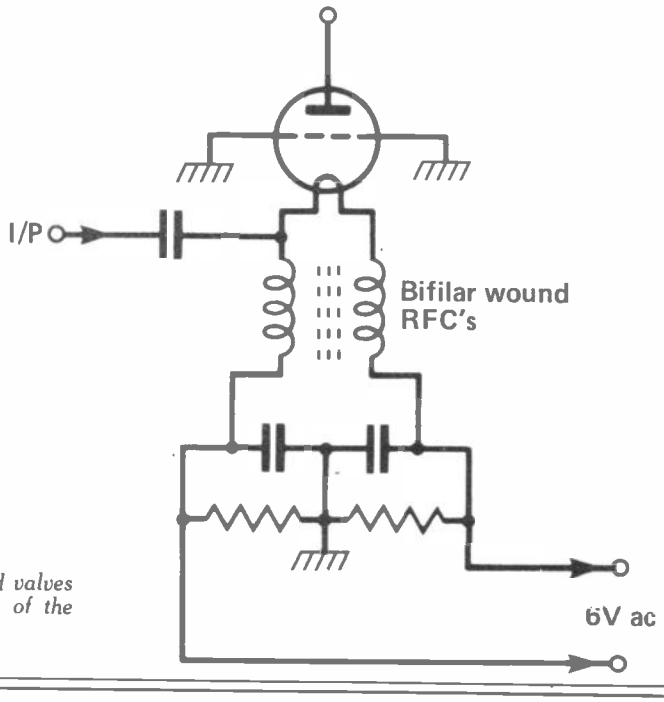


Fig 8 Directly heated valves need careful filtering of the heater supply

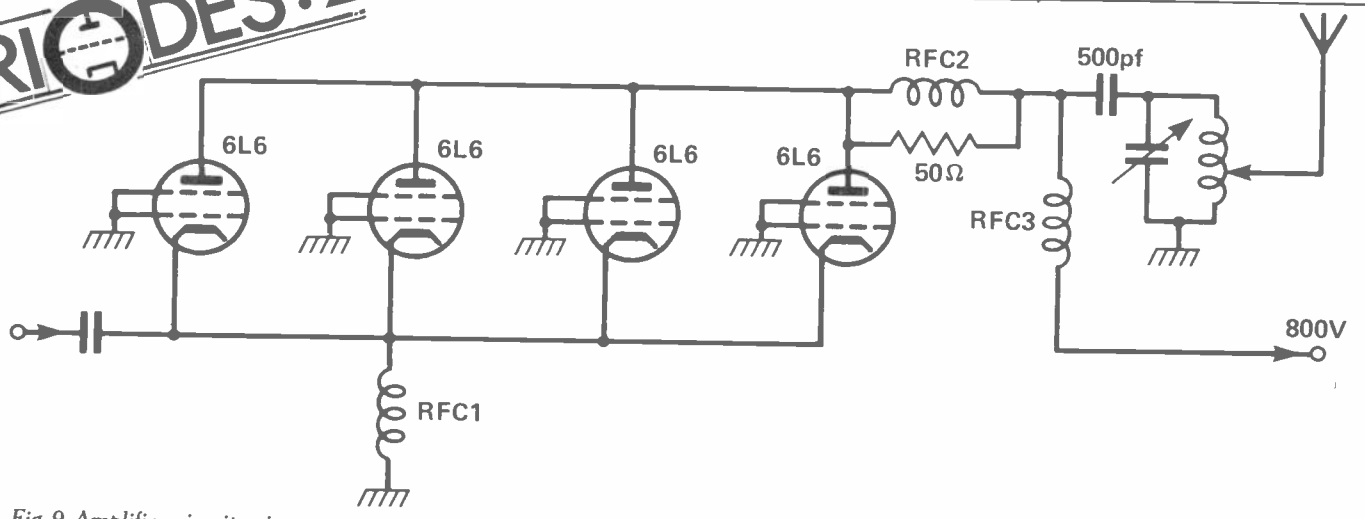


Fig 9 Amplifier circuit using four 6L6 tetrodes

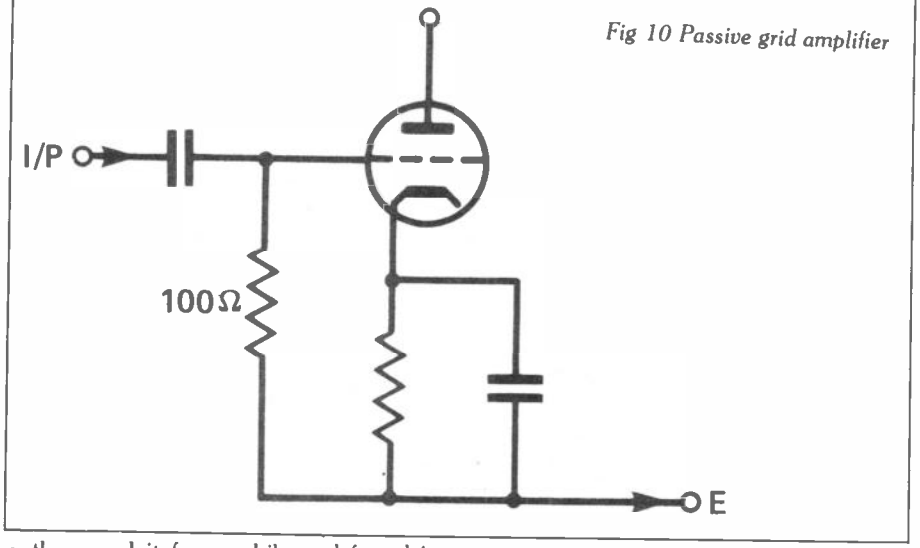


Fig 10 Passive grid amplifier

author used it for a while and found it quite effective. This design was only possible because of the internal construction of the 6J6 and it is doubtful whether it could be applied successfully to other types of valves.

The drive is applied to the cathode

The second technique for preventing feedback from anode to grid is simply by earthing the grid. This may seem counter-productive, for how can you apply drive to an electrode which is solidly earthed?

The answer is that you don't. You apply it to the cathode. Referring back to last month's article you will remember that the anode current is controlled by the grid - cathode potential. It therefore makes no difference whether the grid voltage is varied with respect to the earthed cathode or the cathode voltage is varied with respect to an earthed grid; the end result is the same. Any current fed back by Cag is conducted straight to earth and the stage must remain stable.

The grid need not be earthed to DC; in fact it is often convenient if it is not, but it must be solidly earthed to RF by fixing a capacitor of suitable value between each grid connection and earth. In this way bias can be applied to the stage even though, as far as the RF is concerned, the grid is solidly at earth potential.

Unfortunately, a valve in grounded grid service exhibits a relatively low gain which in transmitter service shows itself as a high drive requirement, while in receivers it is quite common to find two grounded grid stages cascaded in order to obtain sufficient premixer gain. Despite these disadvantages, this type of amplifier gained many supporters due to its relative simplicity, stability and, in receivers, excellent low noise performance.

Bias can be applied even though the grid is earthed

The basic circuit of a grounded grid amplifier is shown in Fig 6. There you will see three new components, RFC1, RFC2 and RFC3. The purpose of RFC1 is to provide a high impedance path to earth for the incoming signal, yet at the same time a low impedance path for the cathode current. If it were not there, the low value bias resistor and associated bypass capacitor would effectively short circuit the incoming signal to earth.

Not so obvious perhaps, is the purpose of RFC2 and RFC3 in the heater circuit. Referring back to the diagram of the heater shown with last month's article it is immediately obvious that the value of the heater - cathode capacitance must be quite high and sufficient to short circuit the incoming signal to earth. Placing RF chokes in the heater lines close to the valve pins keeps the RF where it should be; on the cathode.

High drive

Most large (over 30 watt) triodes are directly heated and therefore have no separate cathode. In this case, the heater chokes are usually bifilar wound on a ferrite rod which provides the required impedance for the input circuit (Fig 8). The DC return for the valve current is either via a centre tap on the heater transformer or by two low value resistors, one from the bottom of each heater choke, to earth.

As said before, the grounded grid power amplifier has a quite high drive requirement, often amounting to 5 - 10% of the output required. This may seem uneconomic, however; most linear amplifiers are driven by commercial transceivers, many of which have an output in the region of 100 watts. When these are throttled back to under five watts output to drive the more sensitive tetrode linears, they frequently give an inferior signal to noise ratio. A legal limit grounded grid linear amplifier requires in the region of 20 - 40 watts drive, at which level the signal to noise performance of the prime mover is unlikely to have deteriorated noticeably.

TRIODES:2

Many valves have been specifically designed for grounded grid service. These usually have a number of separate grid connections, each of which should be individually earthed either directly or via suitable capacitors.

Over the years, many designs have been published which use tetrodes or pentodes strapped as grounded grid amplifiers. Possibly the simplest of these is one using 6L6 valves giving 150 watts output on 80 metres designed by Norm McLaughlin W6GEG. I doubt whether any circuit could be more simple for that output (Fig 9)

Passive grid amplifier

The operation of this type of amplifier depends upon the principle that if the grid circuit losses are made sufficiently high, the feedback via Cag, even when magnified by the Miller Effect is insufficient to cause oscillation. The drive requirements are extremely high and consequently this circuit is not suitable for a signal amplifier.

The circuit is very similar to the standard amplifier with the exception that the grid resistor is of very low value - usually in the order of 100 ohms (Fig 10).

A circuit (Fig 11) which has been very popular for many years as an RF signal amplifier is the cascode. This uses two triodes (or more often, a double triode), the first of which operates as a normal earthed cathode stage, this being directly coupled to the second which is in grounded grid configuration. This effectively loads the first stage sufficiently to prevent oscillation.

The noise factor can be improved slightly by inductive neutralisation, but even without it, noise factors in the order of 4dB can be obtained on two metres by the use of suitable valves. The gain of a cascode stage compares favourably with a good pentode.

Triode T/R switch.

A triode may be used as a very simple transmit/receive switch with transmitters up to about 25 watts output (Fig 12). The signal is taken from the 'hot' end of the PA tank circuit via a low (2·5pF) value capacitor. In the transmit condition a small amount of RF passes through this capacitor, causing a very high bias to be developed across the 4M7 grid leak. This completely cuts off the current through the valve, and isolates the receiver.

In the receive mode, the incoming signal passes through the transmitter tank circuit and the low value coupling capacitor to the grid of the triode. The low impedance output from the cathode of the triode makes an excellent match to the input of the receiver. Any gain lost due to the low value of the coupling capacitor is more than made up by the accurate matching throughout

Although not fashionable today, valve circuits such as described in these articles can still operate effectively, frequently producing better results than their solid state counterparts and just as frequently at far lower cost.

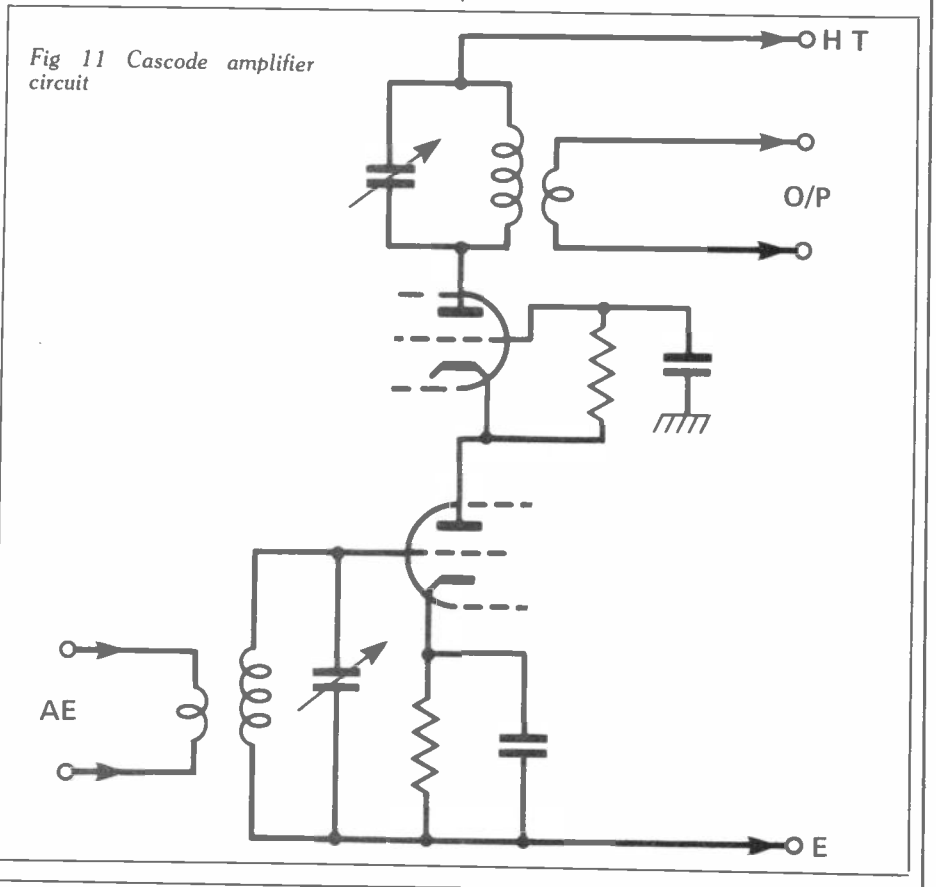


Fig 11 Cascode amplifier circuit

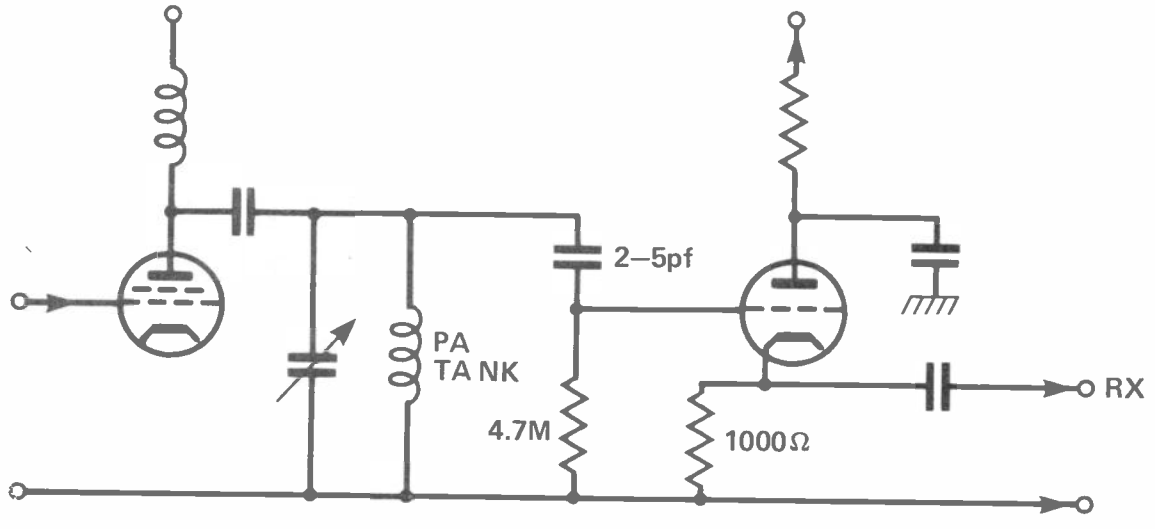


Fig 12 Electronic T/R switch

THE ONLY BRAND WORTH GOING FOR WITH ANY FREQUENCY

...is the brand that gives you the best service in every aspect of Amateur Radio, and it's name is~ICOM, from Thanet Electronics.

IC-751, £969. HF Transceiver

Think about the IC-740, One of the most popular amateur bands transceivers, make a few improvements such as adding 36 memory channels, doing away with mechanical bandswitching and then add full HF receive capabillity (0.1-30 MHz) which is even an improvement on the famous R70 and you get a pretty good idea of what the IC-751 is like. It is fully compatible with Icom Auto units such as the AT-500 and IC-2KL and a further option for computer control can be added. There is also a digital speech synthesizer option which will be ideal for blind operators. For power supplies you have the option of the IC-PS740 (which fits inside) or the PS-15/PS20 range for external use.

As you would expect there is a built in speech processor, a switchable choice of a J-FET pre-amp, straight through or a 20dB pin diode attenuator and two VFOs allowing split frequency operation.

Other standard features include:- 36 memory channels with scan facility and start/stop timers, a marker, 4 variable tuning rates, Pass Band Tuning, notch, variable noise blanker, monitor switch, DFM (direct feed mixer) in the front end, full break-in on CW and AMTOR compatibility. The first IF is 70.045 MHz. Any XIT and RIT adjustment is shown on the display. The transmitter features high reliability 2SC2904 transistors in a low IMD (-32dB@ 100W) full 100% duty cycle. Power is restricted to 40W on AM and adjustable from 10W on all modes. FM and the IC-FL44A crystal SSB filter are both fitted as standard.

As you can see from this brief description the IC-751 is certainly a transceiver worth considering – Why not call us for further details?

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IC-R70, HF Receiver, £499.

The R-70 covers all modes (when the FM option is included), and uses 2 CPU-driven VFO's for split frequency working, and has 3 IF frequencies: 70MHz, 9MHz and 455KHz, and a dynamic range of 100dB. It has a built-in mains supply.

Other R-70 features include: input switchability through a pre-amplifier, direct or via an attenuator, selectable tuning steps of 1KHz, 100Hz or 10Hz, adjustable IF bandwidth in 3 steps (455KHz). Noise limiter, switchable AGC, tunable notch filter, squelch on all modes, RIT, tone control. Tuning LED for FM (discriminator centre indicator). Recorder output, dimmer control.

The R-70 also has separate antenna sockets for LW-MW with automatic switching, and a large, front mounted loudspeaker with 5.8W output. The frequency stability for the 1st hour is ± 50Hz, sensitivity- SSB/CW/RTTY better than 0.32 μv for 12dB (S+N)÷N, Am-0.5μv, FM better than 0.32 for 12dB Sinad. DC is optional

IC-740, HF Transceiver

Features of the IC-740 transceiver include a very effective variable width and continuously adjustable noise blanker, continuously adjustable speed AGC, adjustable IF shift and variable passband tuning built in. In addition, an adjustable notch filter for maximum receiver performance, along with switchable receiver preamp, and a selection of SSB and CW filters. Squelch on SSB Receive and all mode capability, including optional FM mode. Split frequency operation with two built-in VFO's for the serious DX'er.

The IC-740 allows maximum transmit flexibility with front panel adjustment of VOX gain and VOX delay along with ICOM's unique synthesized three speed tuning system and rock solid stability with electronic frequency lock. Maximum versatility with 2 VFO's built in as standard, plus 9 memories of frequency selection, one per band, including the new WARC bands. With 10 independent receiver and 6 transmitter front panel adjustments.

Options include:

- FM Module
- Marker Module
- Electronic Keyer
- 2 - 9KHz IF Filters for CW
- 3 - 455MHz Filters for CW
- Internal AC Power Supply
- Automatic Antenna Tuner

NEW! IC-271, £569. VHF Multimode Base station

Icom have made improvements to the popular IC-251 and brought it up to date.

Power can be adjusted up to 25W on all modes SSB, CW and FM. Squelch works on all modes and a listen-input facility has been added for Repeater work. RIT shift is shown on the display.
Options include: SM5 desk mic. Internal chopper PSU
Speech synthesizer announcing displayed frequency.
22 Channel memory extension - with scan facilities.
10 Hz tuning facility, switchable front end pre-amp.
There is now a 70 cm version available – the IC-471.

IC-251E. Available at special price to clear, £479.

Icom produce a perfect trio in the VHF base station range, from 6 meters through 2 meters to 70cms. The IC-251E is the 2 meter station while the IC-451E is used for 70cms. The 251E is now available with Mutek front-end fitted.

IC-25H/25E, £329/£369. VHF, FM Mobiles

The FM mobile choice has to be the Icom IC-25E. It is so small yet boasts a powerful 25 Watt voice and a sensitive receiver. The new 25H now avaiable has a green display and 45 Watts output. There are five easily programmable memories, and facilities for changing the repeater shift from the default value of 600kHz. You can tune the VFO while in a memory without losing or changing the memory. You can listen on the input instantly, and there are also priority channel facilities should you want to be sure of not missing that private message. The HM10 scanning mike is supplied as standard, but the HM11 with tone call on the mike can be used.

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THE IC-745... ICOM'S VERY LATEST TRANSCEIVER IS WAITING FOR YOU AT THANET ELECTRONICS

£759.

What's the celebration about? The IC-745...a new all band HF transceiver with SSB, AM, CW, RTTY and an FM option.. plus, a 100KHz – 30MHz general coverage receiver.

And...the IC-745 has a combination of features found on no other transceiver at such an incredibly low price.

The IC-745 is the only transceiver today that has so many standard features, options, and accessories available.

ICOM is simply the best amateur radio equipment built today. See the IC-745 at our shop and showroom at Herne Bay or contact your local authorised ICOM dealer for more information.

Compare these exceptional features

- 100KHz – 30MHz Receiver
- 16 Memories
- Full function Metering with a built in SWR Bridge
- IF Shift and Pass Band Tuning
- 10Hz/100Hz/1KHz Tuning Rates with 1MHz band steps
- Optional Internal AC Power Supply
- Adjustable Noise Blanker (width and level)
- Continuously Adjustable AGC with an OFF position
- Receiver Preamp
- 100% Transmit Duty Cycle

Other Standard Features:

- 100 Watt Output Transmitter with exceptionally low IMD
- VOX
- Speech Compressor
- Tunable Notch Filter
- RIT and XIT
- All Mode Squelch
- Scanning
- ICOM System Compatibility

Optional Accessories:

- IC-PS15 External Power Supply
- IC-PS740 Internal Power Supply for the ultimate in Portability
- IC-2KL Linear Amplifier
- IC-SP3 External Speaker
- IC-MB12 Mobile Mounting Bracket
- IC-AT100 Antenna Tuner (100W)
- IC-AT500 Antenna Tuner (500W)
- IC-BC10 Memory Backup
- IC-EX241 Marker Module
- IC-EX242 FM Module
- IC-EX243 Electronic Keyer
- IC-FL52A 500Hz 455KHz CW Filter
- IC-FL45 500Hz 9MHz CW Filter
- IC-FL54 270Hz 9MHz CW Filter
- IC-FL53A 250Hz 455MHz CW Filter
- IC-FL44A 2.1KHz 455Khz SSB Filter
- IC-SM6 Desk Mic
- IC-HM12 Hand Mic

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NEW! IC-120, 1296 MHz FM £419.

Thinking of 1296? Then Icom IC-120 could be the answer.

Now you can have the sophistication of today's technology on this up and coming band-all built into a unit the same size as the IC-25E, very compact...

Features include:	Output Power = 1 W or more
Frequency coverage 1260 - 1300	Mode:- FM
Adjustable Repeater Shift	2 VFO's
6 Memories - with scanning facility	Deviation + 5 KHz
Spurious Emissions - 40dB or better	R I T

8 W and 16W (Puma) Linear Amps available shortly.

IC-290D, VHF. £433. Multimode Mobile

The recently introduced IC-290H has proved so popular that we have decided to concentrate on this (25W) model 2m multimode. With its bright green display, 5 memories, scan facilities on either memories or the whole band, tone-call button on the microphone and instant listen input for repeaters, this little box really is a beauty. The 70cm version, the IC-490E has similar features (although the output is only 10W in this case).

IC-2E, VHF/FM, £179. IC-4E UHF, £199.

Nearly everybody has an IC2E – the most popular amateur transceiver in the world – there is also the 70 cm version which is every bit as good and takes the same accessories.

RTTY, Morse & ASCII

Shortwave listeners and amateurs are able to take more interest in other modes of transmission than speech with the latest range of decoders and senders available. As well as amateur transmissions, there is an abundance of news and other interesting broadcasts which can be read using these space-age devices.

Some models in our range are the Tono 550, 9000E and the Telereader CWR-670, CWR-685E and CWR-610E. There is now available a professional version of the Tono 9000E, the PRO-1, which has a built-in scrambler. The Telereader CWR-670 is also available with a built-in VDU which can include a 40 column printer.

TONO 9000E Sender/Decoder £669.

CWR-610E, Decoder £189.

TONO 550, Decoder £299.

As U.K. importers of the renowned TONO and TELEREADER products, we can offer you a wide range, from a simple morse and RTTY reader which can be plugged into your TV., to a complete send and receive system with memories and built-in displays, or outputs for high-definition VDU.

As well as stocking the complete ICOM range of equipment suitable for European use, we also sell Yaesu, Jaybeam, Datong, Welz, G-Whip, Western, TAL, Bearcat, Versatower and RSGB publications from our shop and showroom at the address below. Come in for a demonstration or just a chat, our qualified sales staff and technicians will be glad to assist you.

Do you know what time it is! £59.

When the globe of this digital clock is revolved, a red lamp indicating a major city in the world will blink, and the current time of that city will be displayed in place of the date. At a glance know the current times of 24 different time zones throughout the world.

This mini-globe clock stands 195mm. high and also has an alarm fitted. This useful device should stop you getting your Amateur friends, on the other side of the world, out of bed in the middle of the night.

Agent Please telephone first, anytime between 0900 – 2200 hrs.

Gordon Adams . G3LEQ Tel: Knutsford (0565) 4040

All prices shown include VAT.
Interest-free credit available
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143 Reculver Road, Herne Bay, Kent
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BARCLAYCARD VISA

··LOOSE·COUPLES·AND·O

"The average opinion of the broadcast listener (or the BCL as he is known in amateur circles) is that the experimenter has little respect or sympathy for the crystal receiver in the next house." In case you think this sort of problem started only with souped-up CB, this florid quotation may be identified as coming from the pages of *The Radio Times* for February 6th 1925.

In those halcyon days, when bureaucracy consisted of no more than a sparetime tealady at the studio end, *The Radio Times* was published by the British Broadcasting Company. As far as we know, dinosaurs still roamed that part of White City on which the BBC Television Centre was to be erected; as they say, from dinosaur to white elephant in a few generations.

In fact, *The Radio Times* was probably far more interesting in those days, since descriptions of programmes were not subjected to purple prose from anonymous copywriters, as is the case today. Anyway, from time to time, the sagely pages of the parchment publication offered guidance for the 'amateur transmitter' otherwise known as the BN (Blooming Nuisance). Still, like those amateurs said, *they* were there first, and complaints from erstwhile listeners were somewhat caused by their getting their crystals in a twist. But, let us drop in on the lantern lecture from the correspondent:

"The amateur transmitting station is usually licensed to employ a power of 10 watts - this amount of current is about equivalent to power consumed by a pair of motorcar side lamps - and is licensed to use a fixed wavelength of 440 metres and a range of wavelengths below 200 metres. However, the fixed wavelength of 440 metres may not be used during the hours in which programmes from BBC stations are taking place. In the lower band of wavelengths, the experimenter has more freedom, for he may employ either telegraphy or telephony at any time during the day or night, **providing** *that he has first ascertained whether his transmission is likely to cause interference to other stations, and that his transmitter is accurately tuned."*

David Lazell once in amateur radio up with a few s

A pair of motor-cycle side lamps

Now, all this advice was but the tip of the iceberg. It reminds me of a time when, as an innocent advertising agency copywriter, I suggested that a client's very tired and dusty advertising be changed, as it had been the same for oodles of years. The client look horrified and explained that he could never change his advertising, unless *all* his customers agreed (an activity which would be akin to the national census). The old-time amateurs had the same kind of challenge. Although the broadcast stations had no legal authority to clobber the wayward experimenter, there was remarkably little use of the 440 metres area - though no doubt some youthful and forgetful gents tried it when they should have been in radio's equivalent of the ninepenny seats. There were only a few free hours on 440 metres, on Sunday afternoons before the broadcast stations tuned up. But, more drama is to follow, dear friends:

"The amateur transmitter is not permitted to use 'spark' and many complaints have been made of Morse interference from an amateur station using 'spark'. In most cases, the cause has been traced to shipping and coastal stations. The BBC waveband at present does not extend below 300 metres and therefore a clear 100 metres separates the amateur from the BCL (Broadcast Listener) and it would appear that no possible interference could occur. In congested areas, where several aerials almost touch, and in many cases run parallel, shock excitation is, unfortunately, noticed when the transmitting station is using telephony.

Radio Times, February 20th, 1925.

THE NERVE-CENTRE OF BROADCASTING. By P. P. ECKERSLEY.

THE RADIO TIMES

THE OFFICIAL ORGAN OF THE B.B.C.

Vol. 6. No. 74. [Registered at the G.P.O. as a Newspaper] EVERY FRIDAY. Two Pence.

OFFICIAL PROGRAMMES OF THE BRITISH BROADCASTING COMPANY.

For the week commencing SUNDAY, . February 22nd.

MAIN STATIONS.
LONDON, CARDIFF, ABERDEEN, GLASGOW, BIRMINGHAM, MANCHESTER, BOURNEMOUTH, NEWCASTLE, BELFAST

HIGH-POWER STATION.
(Chelmsford.)

RELAY STATIONS.
SHEFFIELD, PLYMOUTH, EDINBURGH, LIVERPOOL, LEEDS — BRADFORD, HULL, NOTTINGHAM, STOKE-ON-TRENT, DUNDEE, SWANSEA

SPECIAL CONTENTS:

THE INDIVISIBLE IS DIVIDED. By J. C. W. R.
IN DEFENCE OF JAZZ.
OFFICIAL NEWS AND VIEWS.
LAUGHING WITH THE MUSIC-MAKERS. By Leonard Crocombe.
LISTENERS' LETTERS.

Making Listeners Jump!

By G. K. CHESTERTON.

I HAVE been asked to give my own views about broadcasting, in this organ which is devoted to that science; and the gentleman who asked me made the exceedingly sensible remark that he did not want me to say that wireless telegraphy is a wonderful thing. In that sense he need have no fear.

* * * *

In one sense, of course, wireless telegraphy is wonderful, and ordinary telegraphy is wonderful, and ordinary talking is wonderful, and being able to walk about on the solid world under the staring sun is so overwhelmingly wonderful that no words have ever expressed the wonder. But the danger in these cases is that we shall grow as used to the last marvel as to the first, and yet preserve a mere conversational convention that survives its mood.

One man will say to another in a weary voice: "Wonderful invention!" and the other will reply, gloomily: "Oh wonderful!"; when neither are wondering at anything, or admiring anything, except, perhaps, the one man down the street who still has the moral courage not to talk about wireless.

* * * *

But there is a much more practical sense in which the great discovery is also a great opportunity. And there is an equally practical sense in which that opportunity may only too easily be lost. It is this; that the older modes of communication, which are in their nature roads, have become also ruts. The conventional press, the conventional theatre, the conventional political platform, have become very conventional indeed. They have got into grooves, and the grooves are narrow. There is still a chance that broadcasting may really be broad.

* * * *

I was once asked by a wireless enthusiast to consider what a wonderful and beautiful thing it was that thousands of ordinary people could hear what Lord Curzon was saying.

I replied that it would be much more beautiful if there were an instrument by which Lord Curzon could hear what thousands of ordinary people were saying. But that machine has not yet been invented; and until it is, there will be no true machinery of democratic government. It may be said that some moral qualities are (thank God) beyond the control of any machinery; and that the scientific mechanism that would make Lord Curzon listen to anything which he did not want to hear is beyond the visions of science. But without entering into this question, it may be said that that simple antithesis or reversal, implied in such an anecdote, is the real crux of the question.

* * * *

We talk rightly enough of wireless telegraphy as a revolution; but in one sense it is only too much of a continuity and even a monotony. However wide may be its appeal, it is generally only the old and familiar voices that are appealing. It can only be the publication of public things. It can only concern itself with what is called the public life of those who are called public men. I am stating this fact primarily as a fact, and not as a complaint. I am certainly not implying in the complaint a proposal for the disregard of privacy.

* * * *

I do not mean that I am thirsting to overhear Lord Curzon's playful conversation with the cat; or to listen to a Prime Minister's secret confidences with his maiden aunt. As a matter of fact, we have rather too much of that kind of thing already in the newspapers; and as I shall suggest in a moment, it is the whole danger of the broadcasting innovation that it may merely be an imitation of the newspapers. For we live in an age in which things of purely private interest are made public; as a sort of compensation for things of purely public interest being kept private.

We have a photograph of the politician

(Continued overleaf.)

1

more fishes around tradition and comes straight bananas...

"Very few amateurs use telephony (even on shorter wavelengths than 100 metres) during broadcasting, but to avoid any possible chance of overhearing such transmissions, the broadcast receiver should endeavour to protect himeself to the full extent by using a loose coupled aerial circuit."

Now, it must be said that the BBC did not have a lot of experience with loose couples. The ones it greeted were usually respectable. In the 1930s, the BBC station at Swansea took over an office formerly used by a Registrar of Births, Marriages and Deaths.

No fairies in the kids programmes

"People still come here to get married," complained the local BBC panjandrum. "And they look annoyed when they tell us that it's none of the BBC's business." This absence of Cupid at Swansea reflected the very sensible approach of the BBC. A Children's Hour producer at Cardiff, around the same time, declared that there were 'no fairies' in the kids programmes transmitted from the Welsh capital. There was always a stern approach to life in the Principality, yet the interest in amateurs was real enough. On the night of March 6th 1925, the Cardiff station (5WA) declared its intention of relaying an assortment of continental broadcasters to its handful of loyal listeners. The plan was that of relaying 'Radiola, Paris, Rome, Cassel, Berlin, Madrid, Brussels and anything else that happens to come along, so that listeners with crystal sets may share the joys of distant reception. During the tuning preliminaries, a programme will be given from the Cardiff studio by the station orchestra and Mr. John Perry, tenor.'

The serious amateurs must have listened in that night, if only to have a good laugh.

All the early stations had call signs, just like amateur stations. Shades of postcodes to come, you may think, with the Edinburgh station shown as 2EH; the Dundee, as 2DE; the Nottingham programme as 5NG; Plymough's as 5PY, and so on. London, in those earlier 1920s, had the world-famous 2LO identification. Artists broadcasting from local stations sometimes used the station call-sign to identify their ensembles - the 6BM Trio from Bournemouth included Percy Edgar (entertainer) who was later to manage the BBC Birmingham (Midland) output.

Talks were high-brow enough, and you do not hear that sort of stuff on local radio now. Titles were confusing, too. The eager car service man was likelv to tune into a talk entitled (as he thought) 'what we owe to grease', only to find that the 'grease' was of the Hellenic variety, and all about that ancient home of democracy, Greece.

And if you think your radio shack looks a mite muddled at times, the early broadcast studios were probably much the same. Sometimes a single room had to be used as office and studio, with a curtain dividing the piano and immovable mike. Heaven knows where the do-everything manager put his vacuum flask. Take, for example, Birmingham's 5IT station. This had started out during the very early days when private enterprise was getting into wireless. Western Electric, pioneers of broadcasting in the USA, started an experimental station with the call sign of 4WD, but when the British Broadcasting Company nationalised the system, it became 5IT and was situated in the GEC plant at Witton. Its home was not a marble hall, but a small area in part of a converted warehouse.

Left: the front cover of The Radio Times for 20th February 1925, with an article by G.K. Chesterton.
Below: a programme schedule for the Liverpool station 6LV shares a page with an advert for S.G. Brown headphones. Most of the magazine's ads were for radio equipment and components.

February 20th, 1925] — RADIO TIMES — 415

Liverpool Programme.
6LV 315 M.
Week Beginning Sunday, February 22nd.

SUNDAY, February 22nd.
3.0-3.30.—*Programme S.B. from London.*
8.15-9.0.—Simple Service relayed from St. James's Church, Toxteth Park.
9.0-10.45.—*Programme S.B. from London.*

MONDAY, February 23rd.
11.0-12.0.—Mid-day Concert.
3.30-4.30.—Gaillard and his Orchestra, relayed from the Scala Super Cinema.
5.30-6.30.—CHILDREN'S CORNER.
7.0-10.30.—*Programme S.B. from London.*

TUESDAY, February 24th.
4.0-5.0.—The "State Brighter Liverpool" Band, relayed from the State Café.
5.30-6.30.—CHILDREN'S CORNER.
7.0.—WEATHER FORECAST and NEWS. *S.B. from London.*
Mr. A. S. E. ACKERMANN. *S.B. from London.*
Local News.

The Liverpool Philharmonic Society's Ninth Concert.
Relayed from
The Philharmonic Hall.
Conductor, GEORG SCHNEEVOIGT.
ARTHUR CATTERALL (Solo Violin).
7.30 Remarks on the Works to be Performed.
7.45 Overture, "Carnival" ... *Dvorak*
"Forest Murmurs" ("Siegfried") *Wagner*
Violin Concerto, Op. 61 ... *Beethoven*
JULES GAILLARD (Violin).
ROBERT CURTIS (Cello).
Mme. GAILLARD (Harp).
8.45 The Trio.
"Moment Musical" ... *Gounod* (11)
"Serenade" ... *Malinka*
Jules Gaillard.
"Serenade" ... *Moszkowski*
"Serenade" ... *Toselli*
Mme. Gaillard.
"La Source" ... *Hasselmans*
"Believe Me If All Those Endearing Young Charms" *arr. Mme. Gaillard*
"Serenade Melancolique" ... *Hasselmans*
Robert Curtis.
"The Swan" ... *Saint Saens*
"Celtic Lament" ... *Foulds*
The Trio.
"Angels Guard Thee" ... *Godard*
9.30.—WEATHER FORECAST and NEWS. *S.B. from London.*
Prof. R. S. RAIT. *S.B. from Glasgow.*
Local News.
10.0.—THE LONDON CELEBRITY BAND: Dance Music.
11.0.—Close down.

WEDNESDAY, February 25th.
11.0-12.0.—Mid-day Concert.
3.30-4.30.—Gaillard and his Orchestra.
5.30-6.30.—CHILDREN'S CORNER.
7.0-10.30.—*Programme S.B. from London.*

THURSDAY, February 26th.
3.30-4.30.—Gaillard and his Orchestra.
5.30-6.30.—CHILDREN'S CORNER.
7.0-11.0.—*Programme S.B. from London.*

FRIDAY, February 27th.
3.15-3.45.—Transmission to Schools.
4.0-5.0.—The "State Brighter Liverpool" Band.
5.30-6.30.—CHILDREN'S CORNER.
7.0-10.30.—*Programme S.B. from London.*

SATURDAY, February 28th.
3.0-4.0.—Organ Recital relayed from St. George's Hall.
5.30-6.30.—CHILDREN'S CORNER.
7.0-12.0.—*Programme S.B. from London.*

We want a title for this appealing picture

—suggest one and win a Brown Loud Speaker or Headphones.

Prizes:
First Prize: One H.1 Brown Loud Speaker 4,000 ohms, value £5 : 10 : 0.
Second Prize: One H.2 Brown Loud Speaker 4,000 ohms, value £2 : 10 : 0.
Six consolation prizes of Brown Featherweight Headphones 4,000 ohms, value 25/- each.

THIS charming child study by St. George Hare, R.I., R.O.I., is just typical of the tens of thousands of little users of Brown Featherweight Headphones.
Such a fascinating and expressive picture deserves a good title—can't you suggest a suitable one and win a superb Brown Loud Speaker? Even if you don't win the first prize you may still get one of the half-dozen pairs of F-type Headphones—similar to those worn by the kiddie in the picture. An extra pair of Headphones is always useful, particularly if they are Brown Featherweights weighing but six ounces—none are so comfortable or so popular among children and grown-ups alike.
Send in your suggestion to our Head Office to-day—a post card will do. Closing date Feb. 28th.

S. G. Brown, Ltd., Victoria Rd., N. Acton, W.3.
Showrooms: 19, Mortimer St., W.1. 15, Moorfields, Liverpool. 67, High St., Southampton.

Brown
HEADPHONES AND LOUD SPEAKERS
Gilbert Ad. 2210.

Programmes seemed to have a special interest for the typical amateur. For example, a talk on 'The Cave Man' was given in February 1925, with the Children's Corner devoted to 'Useful Things We Don't Learn at School'. Like, presumably, how to get a job. Bright listeners could get a few bob out of the BBC, too, as stations ran Radio Crosswords (nothing to do with Today in Parliament).

Those getting the right answers could share in a lucky dip for prizes of two and three guineas. You can tell that these were fare more affluent days in the medium. Bournemouth's programme (6BM) on May 8th 1925 offered a review of 'The Drama' as broadcast from the Bournemouth Station, which was, by the way, situated on Holdenhurst Road. "Will the sound of horses' hoofs on snow broadcast? Yes! Will this sound when combined with other sounds, broadcast? No!

"If you listen tonight, we think you will be very interested. We shall reproduce some of our most successful Pictures and Plays for purposes of demonstration.

"Our first attempt at broadcasting running water sounded like shovelling coal. We changed this. How? Listen tonight."

All kinds of programming got listeners writing, or far more rarely telephoning, their local station with ideas about technical improvement. I have a shrewd idea it was just a plan to get amateurs away from their sparking activities. One programme was broadcast without any actual description, and listeners were invited to send in, on paper, the layout for the programme appropriate for *The Radio Times*. Prizes were offered. No prizes were offered for the non-delivery of programmes.

"A curious incident was responsible for the changing of the Sheffield programme one recent evening," declared ***The Radio Times*** *one day in 1925. "A programme should have been transmitted from the Albert Hall, Sheffield. When the performance was due to start, it was found that no transmission was being made. Another programme had to be relayed from the studio. At the end of the Albert Hall performance, the microphone was examined, as it was then found that mice had chewed the moving coil and most of the wood, ie, used for suspending the microphone."*

Well, this kind of thing may occur in cable TV, where troubles cannot be blamed on amateurs doing too much 'sparking' at the bottom of the garden. That life changes little over the years is confirmed by a merry piece written by Robert Magill well over fifty years ago. He reported the types of wireless buff around, and indicated the kind of chat that might be heard on the train to town, all about anodes, and rheostats and grids etc. In the end, the brainiest of the lot would have to be the ten year old son of one's neighbour, who prefers not to upset his father by pointing out what is really amiss with Pa's model but has three sets of his own, all working 101% perfect and built by himself.

Bottle of hair oil

"He likes wireless because he can swank about hearing the Eiffel Tower one night on a set he made from a mousetrap, an old electric light bulb, and a bottle of hair oil. As for the man at the wireless shop, he never gets time to listen, because people are always coming around after hours, and asking for spare parts as a favour. On Sundays, he counts his money. When he looks at his bank paying in book, he thanks Heaven he gave up lending bicycles on hire, and likes wireless very much indeed."

All this was underlined by a statement from the then Chief of Radio Communications of the French Army, Ceneral Ferrié, who, according to the press, said that but for the arrival of radio, the Eiffel Tower would have been demolished. However, as soon as it was recognised as a fine radio aerial, its future was assured.

I hear that a few fellows in Australia have been hanging their antennas on the Sydney Harbour Bridge, which shows that modern architecture is really a friend to the amateur.

Even in 1925 competition between valve manufacturers was intense.

Amateurs were among the most enthusiastic supporters of radio in those years when their interest made all the difference for public conversion to the wavelength art. It's a pity that *The Radio Times* in those days offered lectures rather than encouragement. G.K. Chesterton, in a major feature on the subject, referred to 'the one man down the street who still has the moral courage *not* to talk about wireless'. The silence of the fellow was not due to lack of interest; he was just concentrating on the crossword clues put out by the local station. Then, as now, the prospect of getting a few buckshee guineas to spend on equipment, obliterated all else.

As for the BBC's home in Swansea, one wonders whether they put a sign on the door: 'No Marriages Here'. *That* could have been the origin of some of those TV plays about loose living and other shock excitation.

A Morse Tutor Program for the Sinclair ZX Spectrum

By
Julian Moss G4ILO

The Morse Code is these days a controversial subject among radio amateurs. Loved by some, hated by others, only one thing is certain; since Britain is unlikely to go against international agreements made at the World Administrative Radio Conference in 1979, the code is likely to remain a requirement for obtaining a licence to transmit on the amateur bands below 30MHz for many years to come.

Although many people find learning the code a chore, the tasks may be made easier if you have access to an unlimited amount of practice Morse at exactly the right speed. Records or tapes may be played so often that eventually the 'random' groups of letters become unconciously memorised; practice sessions transmitted on the air or at the local club are useful, but they may not always be at the right speed or at a convenient time for the would-be brass-pounder.

A purpose-built Morse tutor is ideal because it provides an endless supply of random code groups at whatever speed the listener is able to copy. The advantage of a computer Morse tutor, though, is that it can provide 'hard copy' of whatever has been sent, so that any mistakes in sending can be detected immediately. A home computer has many other uses too, both around the home and in the shack.

"... start at about eight words a minute"

The program listed in Fig 1 is for the popular Sinclair ZX Spectrum. This computer, in common with many other home computers, has an internal loudspeaker which can be made to produce a tone, enabling the machine to be used as a morse tutor without any external hardware being required.

The binary representation of each Morse letter and number is held in the DATA statement at line 2010 in the program. When the program is RUN, the user is asked to specify the speed required in words per minute, the length of any extra delay to be inserted between characters, and whether code groups of letters only, numbers only, or both letters and numbers (L,N or B) are required.

The computer generates a sequence of 150 characters at random, in line 2170, and stores them in the array t$. This takes a few seconds and allows the student to compose himself ready for the sending to begin.

The characters are sent by the subroutine at lines 2900 to 2940. This is called by the lines 2200 to 2220 for each character in the array t$, with a space being sent after every fifth character.

The text is then displayed for checking, by lines 2300 to 2330.

The best way to learn Morse is to start at about eight words per minute with a two second delay to allow identification of each character. The speed should be increased as soon as possible to 15wpm, the delay remaining the same. The idea of this is to get used to recognising the rhythm of each character at the target speed.

The length of the delay is then gradually reduced to zero at which point you are receiving Morse at 15 words per minute! It is advisable to gain some practice at receiving plain language, perhaps by listening to some Morse practice transmissions, before taking the British Telecom test.

To anyone intending to learn Morse by this method, I wish you good luck, and hope to hear you on the HF bands soon!

Fig 1 Morse Tutor program listing

```
2000 REM MORSE TUTOR ©J MOSS G4I
LO
2010 DATA 63,62,60,56,48,32,33,3
5,39,47,6,17,21,9,2,20,11,16,4,3
0,13,18,7,5,15,22,27,10,8,3,12,2
4,14,25,29,19
2020 DIM b$(36)
2022 FOR i=1 TO 36: READ j: LET
b$(i)=CHR$ j: NEXT i
2100 REM choose options
2110 CLS
2120 INPUT "SPEED (WPM)?";SPEED
2125 LET speed=.7/speed
2130 INPUT "DELAY (SECS)?";delay
2140 INPUT "LETTERS, NUMBERS OR
BOTH?";o$
2150 DIM t$(150)
2160 CLS
2170 FOR i=1 TO 150: LET t$(i)=C
HR$ (RND*(9*(o$<>"l")+25*(o$<>"n
"))+10*(o$="l")+1): NEXT i
2200 REM send code groups
2210 FOR i=1 TO 150: LET x=CODE
b$(CODE t$(i)): GO SUB 2900: IF
i=INT (i/5)*5 THEN BEEP speed*5+
delay,69
2220 NEXT i
2300 REM display code groups
2310 FOR i=1 TO 150: PRINT CHR$
(CODE t$(i)+47+7*(CODE t$(i)>10)
);: IF i=INT (i/5)*5 THEN PRINT
" ";
2320 IF i=INT (i/25)*25 THEN PRI
NT
2330 NEXT i
2390 STOP : GO TO 2100
2900 REM send Morse character
2910 LET y=x/2: LET x=INT y
2920 BEEP speed*(1+(y-x)*4),10
2930 IF x=1 THEN BEEP speed*3+de
lay,69: RETURN
2940 BEEP speed,69: GO TO 2910
```

A New Look at Wire Aerials 8

QUARTER WAVE VERTICALS

John D. Heys G3BDQ

reveals some novel ways of using this popular aerial

The half wave dipole and the quarter wave vertical (often called the ground plane) are perhaps the most written about of all the antennas used by amateurs. Every book on amateur radio seems to have this 'dynamic duo' described somewhere within its pages; despite all this, the quarter wave vertical is perhaps the most misunderstood of all the simple aerials. It is most certainly not the answer to each and every amateur's prayer, and in many cases it has proved to be disappointing in its performance.

A vertical ground plane has certain limitations. The fact that it is inherently a ONE BAND device is perhaps the most important of these, and running a close second is the fact that for the higher frequencies (above 7MHz) it is often inferior to a dipole or end fed wire for much of the time. A well placed vertical only really shines at certain specific times when the DX is coming in a very low radiation angles. Then it enables the working of really exotic long range DX for some time before that DX is even audible when using conventional horizontal wires.

I have often worked W6 and W7 stations on 14MHz some twenty minutes before they were available on horizontal wires, but only had reciprocal reports of S3 to S5. Later when the angle became higher signals strengths were well up from this on a horizontal antenna.

It enables the working of really exotic long range DX

On the lower frequency bands however (7,3.5 and 1.8MHz) a vertical antenna can outperform most horizontals both in the working of DX or in contacting semi-locals on the ground wave. If we could all get our horizontal wires at least a half wavelength above the ground thjey would then be superior to a vertical, but this would mean having supports at least 70 feet high on 7MHz and correspondingly higher on the lower frequency bands! How many of us can get aloft a 'real' Top Band dipole to be suspended some 250 feet above 'deck'?

It is not the polarisation of a ground plane antenna that is normally advantageous, but the fact that such an antenna can be made to radiate at quite low angles above the horizontal. Incoming signals from places beyond the ground wave zone do not exhibit a consistend polarisation, and the effects of the ionised layers high above are responsible for this. A vertical receiving antenna is of no advantage in the reception of DX which was vertically polarised when it left its transmitting aerial. It will only help in the reception of such vertically polarised signals coming from within the ground wave zone. This is a fact that was soon learned by the exponents of CB DX!

Theoretically it should be possible to tie a quarter wavelength of wire to a wooden pole which has been set up vertically and pushed into the ground; connect a length of 50ohm coax to it and join the feeder shield to a metal spike which has been hammered in adjacent to the aerial, and then set about working the DX! Should you be one of those rare individuals who happen to inhabit a salt marsh, these simple directions should suffice. Personally I have never lived on or near a salt marsh and it is doubtful if many of the readers have, so an alternative ground connection must be devised which may hopefully exhibit some of the characteristics of a 'perfect' earth.

Earth conductivity is a variable factor dependent upon the local geology and also the ever changing climatic conditions. This summer my garden has an earth resistance which is many times higher than the norm found during the wet winter months. The 'goodness' or low resistivity of the earth around the base of a quarter wave vertical antenna is all important. It ensures a low angle of radiation from the antenna and also determines its feed impedance. A circle of some eight or ten metal pipes or rods (copper or aluminium) each one knocked into the ground for at least six feet and all connected to the coax braid at the foot of the aerial with low resistance thick wire or similar braid is one way to lower the earth resistance and reduce aerial power losses.

This technique is recommended by the makers of certain commercial vertical 'trapped' antennas. The writer has one of these antennas and by additionally laying out several 20ft lengths of buried wire radially from the aerial base and joining these to the ground stakes a good match to the feeder and a low SWR on all bands has been made possible.

Instead of such ground stakes and buried radials a more usual ploy is to have elevated horizontal radials or 'ground planes'. Each of these wires is cut to be a quarter wavelength long at the operating frequency, and they can range in number upward of the minimum of two. The greater the number of radials the closer will the antennas radiation pattern resemble that of the 'perfect' quarter wave; that is equal all round low angle radiation with no gaps or odd lobes in certain directions.

Insulation

The vertical itself is often fabricated from metal tubing and is a self supporting structure insulated from the ground at its base. An equally effective radiator is made from wire fastened to a wooden or plastic pole. It is not necessary or insulate this wire from a plastic or glass filve support but when using bamboo or ordinary timber it is best if the top 20% of the wire which is at a higher impedance than the lower part is separated and insulated from the support. The final few inches are best left self supporting for it is here that the voltage is highest when transmitting.

With powers of 100 watts or more into the vertical made of wire, corona discharges may sometimes take place in certain weather conditions. This can be prevented by soldering a small metal ball ($^1/_2$ in diameter) to the aerial's topmost tip. My local locksmith and security shop sell small brass door knobs intended for cupboards and cabinets which can be easily converted into anti-corona devices.

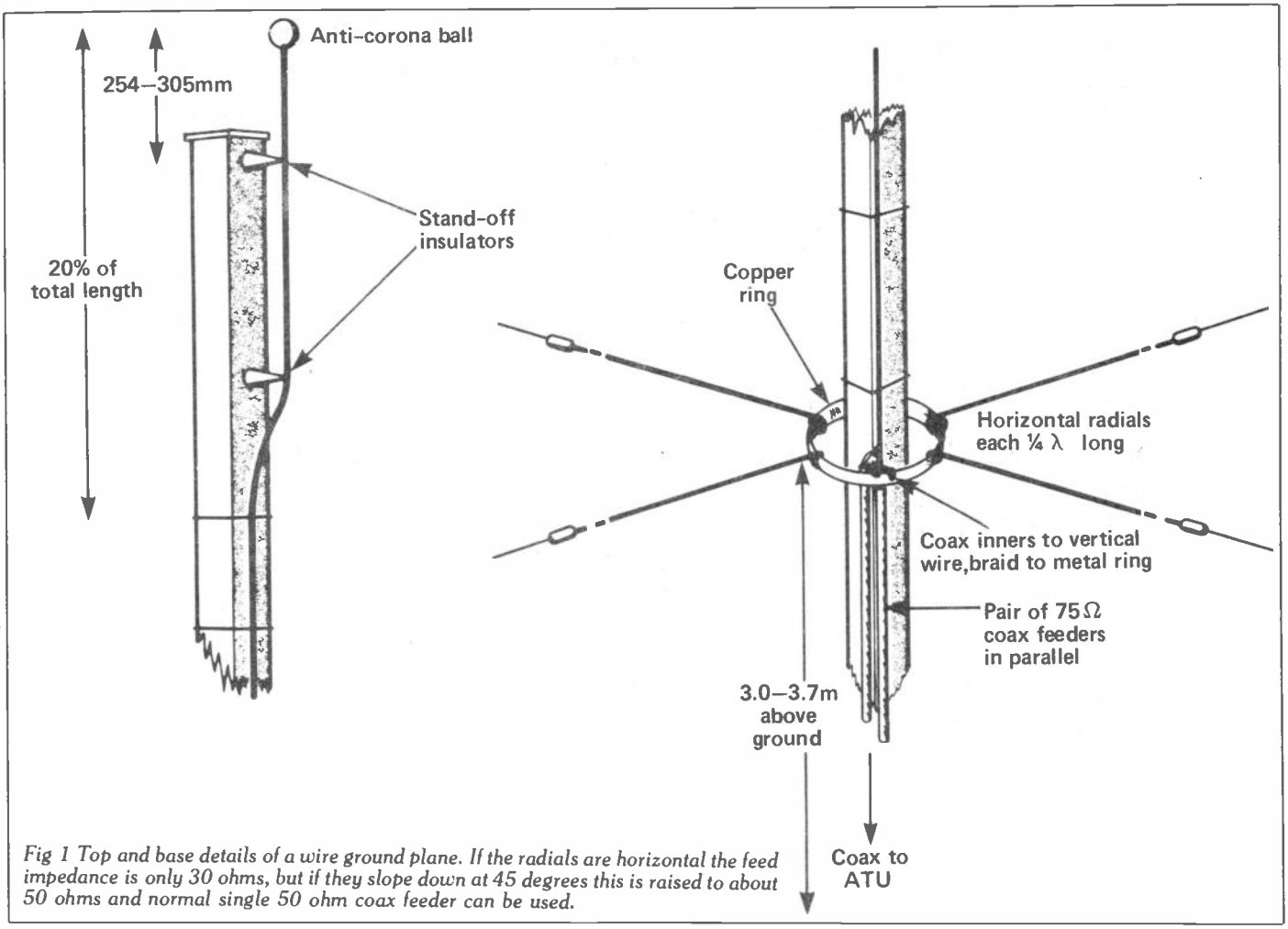


Fig 1 Top and base details of a wire ground plane. If the radials are horizontal the feed impedance is only 30 ohms, but if they slope down at 45 degrees this is raised to about 50 ohms and normal single 50 ohm coax feeder can be used.

The feed impedance of a ground plane as described will be of the order of 30 ohms; not a good match for standard 50 ohm coax. Some 15 years ago G3BDQ used a similar aerial cut for use on 14MHz and achieved an almost perfect match at the antenna end by using two equal lengths of 75 ohm coax in parallel (impedance then 37 ohms) and having an ATU in the shack to raise this to the 50 ohms needed to suit the rig. Sloping the radial ground plane wire to an angle of approximately 45 degrees will raise the antenna feed impedance to about 50 ohms, but the much desired low angle of radiation will be degreded if this is done. The steeper the slope of the radials, the higher becomes the feed impedance until eventually the set-up resembles a half wave vertical dipole with several paralleled wires for its bottom leg. It is a well known fact that half wave dipoles running vertically with their lower ends just a few feet from the ground are no more than useless pieces of garden furniture!

The length of wire needed for a quarter wave vertical may be calculated from the formula: $\frac{234}{f(MHz)}$ the answer being in feet. Each radial should also be this length. The actual lengths are not however critical, for quarter wave ground plane aerials are fairly broad band assemblies, and if cut for a midband should be equally effective over the whole of the band with a reasonably low SWR. The radials are best brought to the base of the radiator and than soldered to a stout copper or brass ring about six inches in diameter which encircles the actual vertical section at its food. This ring is held in place by the tension of the radial wires. A flexible copper braid connects the ring to the outer shield of the coax and liberal coating of a silicone based sealant over the end of the coax cable will prevent ingress of moisture.

Ground plane wires could prove lethal if they happen to run at jugular vein height!

One · snag with the antenna as described in its untidy and hazardous layout of ground plane wires which could prove lethal if they happen to run out at jugular vein height! The system used on 14MHz by the writer was arranged so that the base of the quarter wave vertical section was about 12 feet from the ground. This made it all safe and prevented inquisitive and idle fingers receiving nasty RF burns from the ends of the radial wires. It additionally and usefully meant that the point of high current and maximum radiation (at the base of the aerial) was elevated and so allowed the RF a good take off not screened by bushes, garden sheds, walls fences and the like. The coax feed must run down vertically below the antenna to ground level, and from there may be safely buried along its run to the shack.

A little more than 20 years ago I lived in a very tall four-floored Victorian house which had a terraced back garden sloping steeply downwards away from the property. The shack was up on the top floor which meant that a normal ground plane antenna was a non-starter, for its feeder would have to come up vertically from ground level for a considerable distance. For this reason vertical aerials were never seriously considered and the trusty end fed wire strung out to an old oak some 150 feet away was the workhorse for all bands.

In 1960 a home brew 50 watt SSB transmitter was in use and some excellent results were obtained, that is, until an attempt was made to join the breakfast time 'super DX' gang on 80 metres. It was most frustrating to hear the 'big names' of those days working the world and throwing back S7 to S9 reports to the DX when I was only hearing it some three or four S points lower and could never achieve any QSOs. The end fed wire was too near the ground (about 60ft up) to be effective on 3.7MHz as a low angle radiator so an alternative had to be found.

Working from the premise that a vertical quarter wave has a very low impedance at its base and a high impedance at the top it was decided to try out a *top fed* vertical.

Nothing in any of the available handbooks suggested such a system so there was no way to confirm that it might work. The only remedy was the 'suck-it-

Fig 2 The original 'G3BDQ Top Fed Special'. Although the wire slopes at an angle of about 30 degrees the antenna performed as a vertical on 80 metres. A good earth connection is essential for this antenna. Only a short run of open wire feeder is needed for this design.

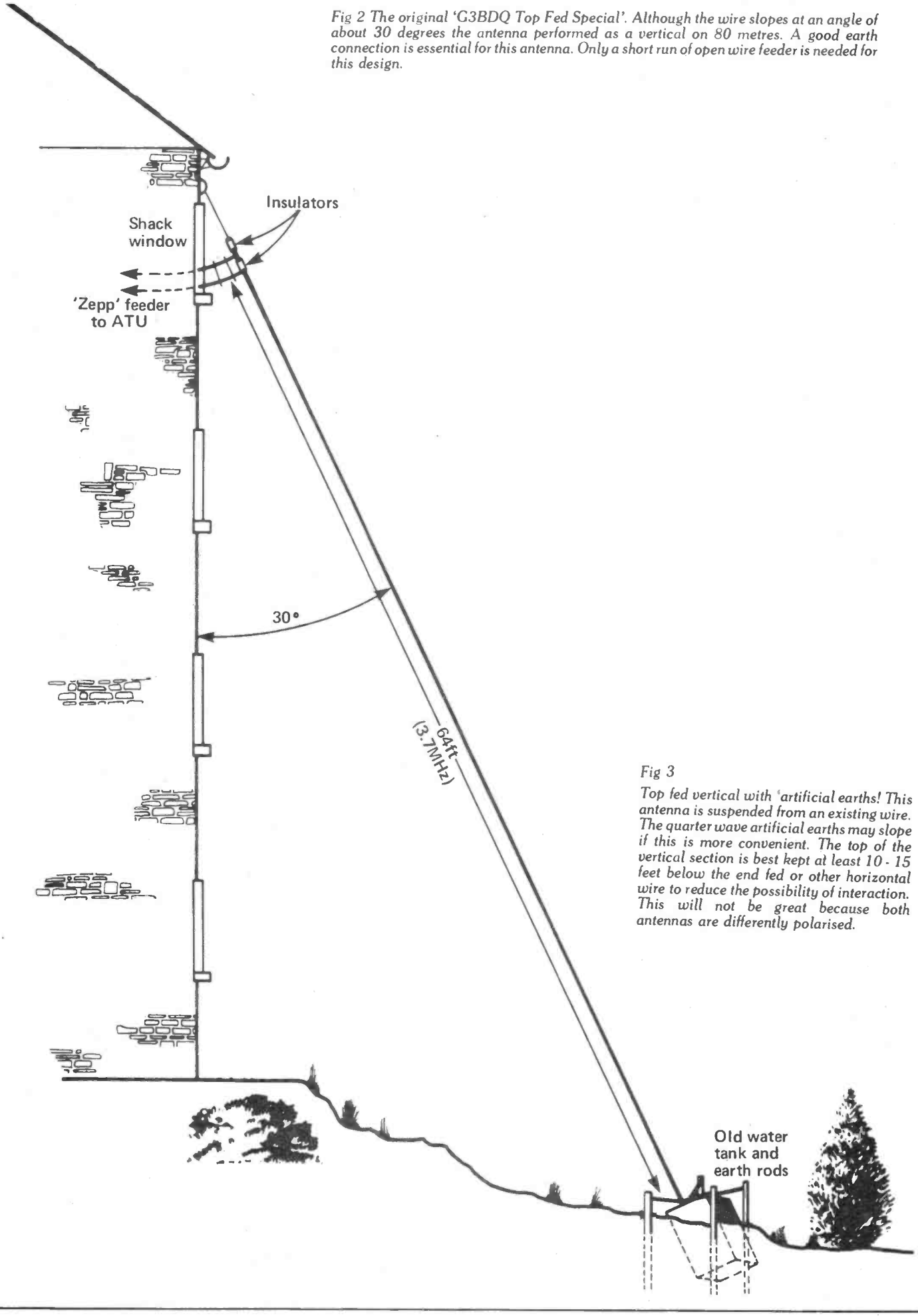


Fig 3

Top fed vertical with 'artificial earths! This antenna is suspended from an existing wire. The quarter wave artificial earths may slope if this is more convenient. The top of the vertical section is best kept at least 10 - 15 feet below the end fed or other horizontal wire to reduce the possibility of interaction. This will not be great because both antennas are differently polarised.

and-see' technique. There was little to lose, for the entire antenna could be made from a length of copper wire (then easily obtainable at little cost from a builders' merchant). A 64ft length of 18swg bare copper was taken down to the garden and one end was well earthed to a half buried ruinous galvanised water tank that had been abandoned by a former owner of the property. In addition extra earthing rods were hammered in nearby and all connected to the end of the wire. The wire was than taken up at quite a steep angle (about 30 degrees from vertical) to a point just a few feet from the shack window. A couple of pyrex strain insulators (only pence to buy then - those were the days!) allowed the connection of an open wire 'zepp' feeder to the top of the quarter wave and also provided a suitable tie point for a length of nylon cord which ran up to an anchorage just above the window and near the roof. The open wire feeder went into the ATU, a "Z" match, and everything tuned up beautifully. During the rest of that day tests with European stations showed that the new antenna performed reasonably well but was always one and often two S-points down on the end fed wire. The next morning arrived eventually and all was ready for a DX session!

During the next few weeks G3BDQ had a ball! Each morning before dragging himself off to work he worked numerous DX stations in N.America, Australia and New Zealand together with a few from S.America over the long path. The fifty watts did not bring back many S9 reports but nice S4 to S6 reports became commonplace. The antenna certainly worked and it was subsequently described in the old *RSGB Bulletin*, the forerunner of the present *RadCom*, and it remained in use until a move was made to a better QTH up on a 400 foot plateau!

Open wire feed allows matching to just about any serial impedance and it has a very little loss; much less than coax or 300 ohm ribbon. For decades amateurs fed the high impedance ends of their half and full wave antenna wires with the open wire 'zepp' system so there was no reason to suppose that the high impedance at the top end of a quarter wave should be more difficult, and this was proved to be the case.

Anchoring the base of a vertical to a buried earth conductor has its disadvantages; the antenna is going to be near the ground and it is not always easy to put enough area of metal into the soil. If the wire is raised so that its base is well up it is still possible to 'earth' the lower end, impossible as it may at first seem. A resonant quarter wavelength of wire such as is used for normal radials will behave as an 'artificial earth' when joined to the lower part of a vertical quarter wave wire. This automatically ensures that the top of the radiator is at high impedance.

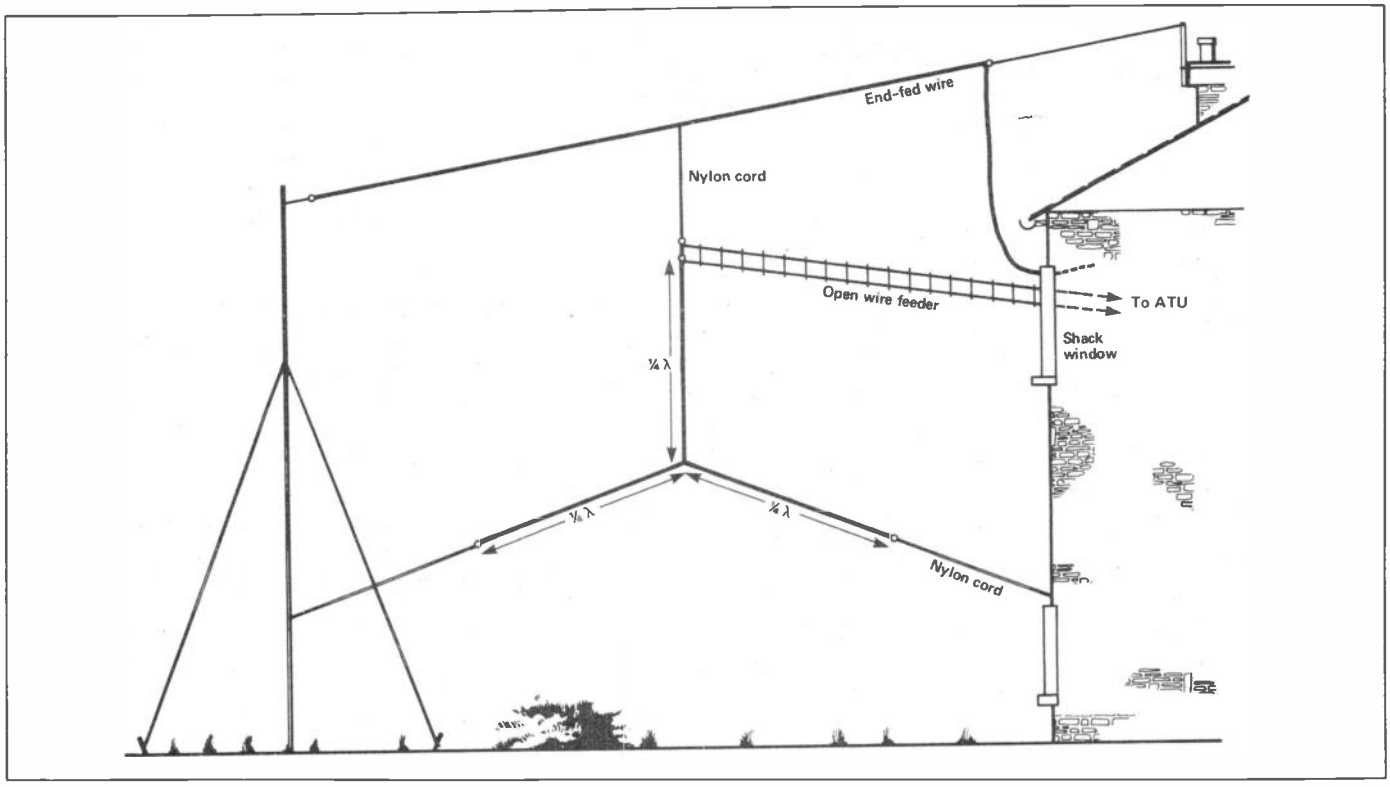
For really sound artificial earthing, two or more quarter wave wires may be connected to the foot of the antenna. They are best run out horizontally but will still work if allowed to slope down at an angle. Such artificial earths can be also made by winding along metre lengths of plastic water pipe enough wire to behave as a resonant quarter wave.

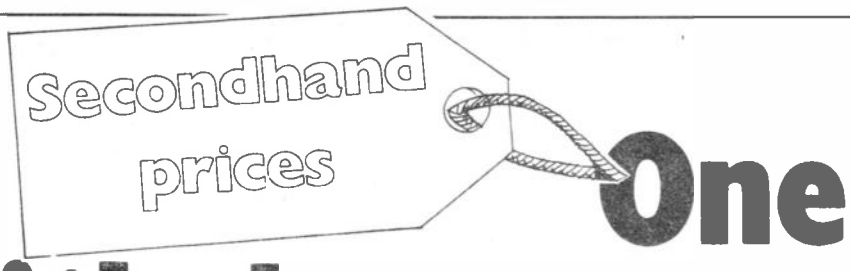
A dip oscillator and some patience is needed to make these coils and their use will degrade the aerial performance by one or two dBs. They also, like all coils in antenna circuits, reduce the bandwith of the aerial and the system must then be carefully cut to work on or near the desired frequency. There is always a price to be paid when taking 'short cuts!'

Holding up the top fed quarter wave can be accomplished by hanging the complete antenna down from an existing horizontal wire aerial or a horizontal rope. For a while I used this system and had a 28MHz vertical which was suspended from the end fed long wire. It did not seem to affect the performance of the latter and it certainly worked well when the sun spots were available a few years ago.

Quarter wave vertical antennas down at ground level are not really suitable for general use if big signal reports are expected. An ordinary horizontal or sloping dipole is a much better bet for this, but for serious DXing on the lower frequencies or for the occasional and exceptional performance possible on the higher frequencies a vertical can be very worthwhile. Those with short gardens will find vertical aerials perhaps the only way to 'get out' and yet remain within a low budget. Those commercially produced self-supporting multi-band trapped verticals which are advertised by several manufacturers are now becoming rather expensive, but are the only way to get going on more than one band if space is restricted and the site is impossible for the LF bands.

These antennas are best placed on top of a garage roof or up on a high building and used there with a multiplicity of wire radials cut for the different bands. They can be very effective if up high. When stuck down near ground level in a garden they are poor performers on ten and fifteen metres. Before buying a similar vertical first check that the bandwidth will suit one's needs. Most are very narrow on the lower frequency bands (40kHz for example on 80 metres). Check also that on its lowest frequency band that it can handle the power normally used. Some trapped verticals can only copy with 100 watts on 3.5MHz and a linear would 'blow' the traps.





One titled owner...

Rallies in Derby and Preston, transistors from Japan and repairing Russian tellies. All from Hugh Allison G3XSE.

Quite an international column this month, with lessons coming up on both Japanese and Russian components, but first a review of the rallies attended this month.

DERBY

This rally got off to a bad start, due to the organiser's insistence that no-one be admitted to the site until 11 am. This caused a tail back to the ring road and beyond, with resultant chaos. The local Fuzz intervened in the end, the actual Police Constable involved politely but firmly insisting that the gates were opened there and then. It wouldn't really take much more organisation to allow the public into the car park area as they arrive, and keep them out of the site until 11 am.

The bring and buy area was mainly on 'by the hour' tables but the bargains were few and far between this year. It was noted that IC2Es have now dropped to £100 secondhand, with many good clean examples changing hands for this sum.

A massive junk auction just after lunch did produce a few bargains, but all in all most people that your scribe spoke to considered it a little down on previous years.

PRESTON

This was a different kettle of fish, your intrepid reporter was buying bargains all the time, and strangely enough from stalls rather than the bring and buy. A few locals had decided to have massive clearouts and taken stalls themselves rather than pay the 10% commission. One stallholder had bought up the surveillance system from the Mersey Tunnel, and was doing a brisk trade in Pye Lynx TV cameras at £5 a time. These cameras are quite old, you may be unlucky and get one that is 405 line with a VHF modulator in it, but the handbooks are freely available and the units are easy enough to work on. On the subject of TV cameras, it makes me cringe to see people pay out good money for a camera and then hold it upside down, ie. the 'lens' end pointing towards the floor. You should *never, ever* do this, with any vidicon type camera, since, during normal use, flakes will come off the cathode of the tube. These normally lay where they fall, or at worst go up the front of the tube, at the bottom, in an un-scanned area of the target. If you hold the camera (or a used tube for that matter) upside down, there is a good chance that these flakes will fall onto the scanned area of the target. The actual impact of the fall may damage the target, ot the flake may stick. Either way you end up with a dot on the screen of the displayed picture, always in the same position. Another tip with TV cameras is to disconnect the tube base if working on a duff camera. Check that you have scan drive to *both* scan coils (vertical and horizontal) before reconnecting, since prolonged running with no scan can also damage the target.

JAPANESE TRANSISTORS

You are about to be educated. In the immortal words of Michael Caine, not many people know this. Let us suppose you have bought, nice and cheap a non working transceiver made, not surprisingly, in Japan. You attack it with your massive array of test equipment and quickly find a duff transistor. Out with the solder sucker and soldering iron, and you soon have in your hand a transistor marked, say, C1222. Your attempts to buy a replacement, or more likely, an equivalent, will meet with no luck, because it is really a 2SC1222. Virtually any Japanese transistor marking starting with an A,B or C followed by a four digit number should be prefixed by 2S. In practice it's often quickest to look it up in a listing such as a data book then try and find an easier way to obtain one either side of it in the listing. For IF low power audio and low power modulation transistors a 2N2369 will often do, but take care with the pin outs. Jap transistors often have the base at one end.

RUSSIAN TELEVISIONS

I honestly cannot recall a rally that I have attented where a Rigonda television has not been up for sale. The earliest Rigonda was about a six inch cube, without its power pack, and this model, along with the slightly later 'starlet' model, change hands for between £15 and £20 depending on condition. The later 402 series normally fetch £25 to £30. However they go for about £5, at the most, in a not working condition.

A quick 'primer' in the Russian language to help you repair these sets is that "B" equals "V", "K" equals "F", so a capacitor marked 5MK6B is a 5uF6V device. 3,6 and R are emitter, base and collector respectively, but most of the foregoing can be discounted because there are several stock faults. Before purchasing, check the appearance of the screen.

A mottled or blotchy screen means air has entered the tube. These are obtainable, new, for about £12. Given that the set may only be worth £15 when working it may not appear worth buying, but it is. This is because the next stock fault is a shorted turn on the Line Output Transformer (LOPT). The average Rigonda draws 400 to 800 mA on 12 volts. Over an amp. with good sound, and it's probably the LOPT that's gone, which will again set you back about £12. The sheer availability of these sets 'not working' for a couple of quid means that if you buy enough sets you must get one working at a reasonable price. The electrolytics go open circuit quite often. A most infuriating fault is good sound, good picture, no frame or line lock. This is often the electrolytic on the 100V rail gone open circuit, C33 on the 402 series. If you want new spares, Technical and Optical Equipment, Zenith House, Edgware Road, London NW4 can often help. I quite enjoy repairing these sets since, surprisingly, there is lots of room inside them to accommodate spares that are more or less the right value but the wrong size.

ITT STARPHONES

The UHF FM mobile starphone can often be bought quite cheaply these days. Several have been seen, really rough but complete, for £1, although you can expect to pay up to £5. Good clean working ones crystalled up on the channel you want (say the local 70cm repeater) are probably worth £25. A really infuriating fault that can drive you crazy is so simple and obvious you might overlook it. When you press the transmit button the red lamp should light up. If it doesn't, do not think it is just the bulb, take it out and check it. If it has gone a 12 to 15V 50mA bulb should be put in to check that it lights. The 'on' bulb next to the 'TX' one can be used, but do check this out, because the transmit/receive swithing is done electronically. The transistor that drives the bulb (it's the one in the middle of the little board at the front) also enables the transmitter to the aerial. Thus, if the bulb doesn't come on, the transistor is blown, the transmitter transmits into itself and you get, typically, less than a watt out and some unwanted whistles on your modulation.

•PROCEDURES• 7

Technical Editor Nigel Gresley continues his dissertation on the language of Samuel Morse. Literally translated, of course, it doesn't mean anything to the layman. But it's an easy matter to interpret those rows of letters.

Here we are again, back on the key. You'll remember that last time we ended with Bill, G2YYY, replying to George, GM2ZZZ and here's what he sent:

GM2ZZZ DE G2YYY FB GEORGE ES UR SIGS SLD NO QSB - MNI TNX FER NW QTH SQUARE - RIG HY IC251E WID MUTEK BOARD RNG ABT 10 WATTS ES ANT IS 14 ELE PARABEAM AT 60 FT AGL - QTH IS 30 FT ASL HI HI - HVNT WKD GM FER SUM TIME ES VY NICE TO HR U TONITE GEORGE ES R U QRV 432? HVE NP E E E E NOT WKD GM ON 432 - HW? GM3ZZZ DE G2YYY KN

Well, that shouldn't have been too difficult to follow - remember, as we said last time, that the hyphen is -....- and is sent on order to break up the sentence a bit and let the chap on the other end get his breath back, as it were. Some people send a double I, which is .. .., to do the same job. So Bill replies to George and says that his signals are solid with no fading (SLD NO QSB) and thanks him for the new square - he obviously hasn't worked YP on 144 MHz before. He tells George that his rig is an Icom IC251E with the Mutek front-end board and running about 10 watts to a 14-element Parabeam at 60 feet above sea level and says HI HI. Wot? Well, HI is a way of saying in a couple of characters that something is a bit odd or sad or funny or something like that - the textbooks usually translate it as "laughter" but there are some nuances in HI which are a bit more than that! In this case Bill is saying in effect that his QTH isn't exactly the best VHF site in the world since it's only 30 feet above sea level and that that's one of those things!

Aitch Eye

At this point it's time for a bit of special pleading. There has always been a tendency to use CW-type abbreviations on phone, which is harmless although it's a bit irritating - why say "the QTH here is Birmingham" when you could just as well say "I am located in Birmingham" or some such - but things like HI really do sound silly when used on voice modes. You sometimes hear the expression "Aitch Eye" in the middle of a sentence, such as "well, I'm not all that well sited to the south here, aitch eye", which just sounds ludicrous! Please, please, let's leave Aitch Eye in the same place as "the personal" and "You Have Golf Figure Six..." and "Dah-di-dah" and "the handle" and all the other fatuosities - ie. in a large sack at the bottom of a particularly foul and smelly pond. If you're using voice modes for goodness' sake use the Queen's English and let's abolish this quasi-military quasi-silly abbreviations-for-everything kick before we all get run in!

E E E E stuff

Right - where were we? Bill says sthat he hasn't had a contact with Scotland for some time and that he's delighted to be hearing George tonight - note the use of constructions such as TONITE, which is just a way of economising on the characters which need to be sent and which happens all the time in CW. He also asks whether George has 432MHz available, presumably in order to work him on that band too - yes, he says he hasn't worked GM on this band. But what's all the E E E E stuff?

Well, we all make mistakes and when you send the wrong character in CW (or on RTTY, for that matter) you send a string of Es meaning "error". The error here is that Bill meant to say NOT, send here is that Bill meant to say NOT, sent NP instead of NO, realised what he'd done and sent some E's and then had another go, so NP E E E NOT means "sorry, I didn't mean NP at all, I meant NOT". And so he hands the transmission back.

Several things could happen here, and either they could go on nattering for a while, perhaps going to 432 and trying there, or they could wrap it up. Let's now jump forward in time to the point at which they've decided to sign with each other and see how it's done because obviously you can't just stop sending - there has to be an organised way of signing off so that you can let any other listeners or potential callers know of your intentions. Let's imagine we come across something like this:

....SO WILL SA VY 73 ES MNI TNX FER FB QSO 73 ES BCNU AR GM2ZZZ DE G2YYY KN

R R TNX FER QSO ES HPE CUAGN SN BI FER NW 73 73 ES TU AR G2YYY DE GM2ZZZ SK E E E E

In other words, G2YYY says "73", which is Morse for all the best, and many thanks for a most enjoyable contact - BCNU is "be seeing you", surprise surprise! GN2ZZZ comes back to say thanks and "hope to see you again soon" (HPE CUAGN SN). TU is thank you. SK is signifying the end of the contact, and it's followed by a couple of dots which G2YYY will also send back as a way of saying "OK, I copy your final". It's a lot easier to do than to say!

You could use VA instead of SK if you wish - although they sound the same, of course, different books write them as different letters and the sound is the same; ...-., followed by . . just to say OK, fine, all copied, cheerio. What happens next is variable. If one or other of the chaps wanted to close down he would send CL after the SK to signify closing and you wouldn't normally call someone who had sent CL unless either a) you knew him very well b) either you or he were rare DX for each other or c) there was some other excellent reason.

Getting started

There are various other ways of signing but that one is the most common and the others are usually derived from it. Some Europeans will simply end with 73 and KN or 73TU and there are all sorts of other odd variants but you get the general idea.

Okay - that should give you enough to chew on in order to get started, so we might just spend a little time talking about CW generally and when it's a good idea to use it. We'll confine the discussion to the VHF and UHF bands for now, since HF CW tends to be a bit different and the idea is to get you off the ground with the VHF rig you already own.

Assuming that you've passed the test, your first CW QSO really ought to be with someone you know and with whom you've set up a sked in advance - launching yourself into a CW contest or a big tropo opening when there's a lot of CW is a good way to make you swear you'll never touch a key in your life and that would be a great pity! The best thing is, as we've said, to try having a natter at a speed you can manage with someone you know well and who is a good signal with you. As you do so it's a good time to learn how to do without writing it all down; assuming you're an ordinary

mortal you've probably learned enough to get through the test but, like many other tests in life, that qualifies you to start learning all by yourself. At first you'll be hard put to get the gist of what's being sent without writing it all down; don't worry because as you get some practice you'll find out very soon that you're keeping things in your head for longer at a time and that you're writing down the essentials like name, RST and QTH locator and physical location only.

20 words a minute

As you do this over the course of a QSO or two, you'll find your Morse speed starts to creep up. If you can manage to find people who are sending at a speed just slightly faster than is easy to copy for you, you'll find your own speed goes up by leaps and bounds. The next barrier after about 12 words a minute comes at about 16 or 17 words a minute for most people, and you may find that this is your limit for a few weeks. Then one day you'll wake up and discover that you can quite easily copy things at about 21 or 22 or so wpm and most ordinary operators find this is their highest comfortable speed for run-of-the-mill contacts. In contests, where you know more or less what's coming, you can probably do better than this but you will find about 20 words a minute is easy to reach with a little effort and that's plenty fast enough to 99.9% of all traffic on the amateur bands.

Don't make the fatal mistake of sending at a speed faster than you can copy. Sending is much easier than receiving, especially with an electronic keyer of some sort, and you'll find that people tend to come back to you at the same speed or even slightly faster than you send to them for some strange reason. If you hear someone who is sending faster than you can cope with, there's no slight or slur in sending PSE QRS - everyone had to start somewhere and the vast majority of people will slow down for you.

Activity night

When you've dabbled in CW a bit, the next good thing to try is CW Activity Night, which from time immemorial has been Mondays at 2000 GMT on 144MHz. It's on an average Monday evening that you'll find out just how much CW can extend the range of your station and you'll probably knock off some new QTH squares and counties with an ease which will surprise you. You may also find that your receiver leaves something to be desired if it's an ordinary black box where the CW facilities are something of an afterthought and the filters are distinctly on the barndoor side for CW work. In this case you may well find that it's time to build an audio filter of some kind, or if you really are a non-starter with the soldering iron lash out for one of Mr Datong's clever beasts like the FL3 multimode filter or even the ANF we've reviewed in this issue. The FL3 is a real corker - we've used one for about a year now at the home station and, come to think of it, we've never given it a formal review (must do that sometime). It's very useful for SSB as well as CW and it's the answer to a maiden's prayer if your wireless isn't too scintillating in the filter department.

Doppler shift

You'll find this particularly when there's a CW contest or an opening when stacks of people are on the key and you can hear two or three QSOs going on at once. The brain is very good as 'tracking' the signal it wants but it's much les of a chore if the filters in the wireless do the job for you and you'll get on with sussing out whether the 0Z2 you can just hear in there is in EP square, which you have worked, or ER square, which you need.

CW is superb during openings because (a) not nearly as many people go on the key as go on SSB so you can have some choice DX all to yourself instead of being in a pile-up with about 10 others - curses, what am I saying? Talk about trade secrets. (b) problems of QRM are much lessened, especially if your filters are up to it, and you have a much better chance of completing the QSO without having to ask for repeats every time and (c) when the signals are weak, such as when the guy on the other end or yourself are at the extreme range of where the tropo is going, CW is really the only way to go. It's much more fading-proof than SSB under these circumstances and you'll work the guy much more easily than if you were doing the "...please repeat the last letter of the locator again, go ahead" bit on SSB!

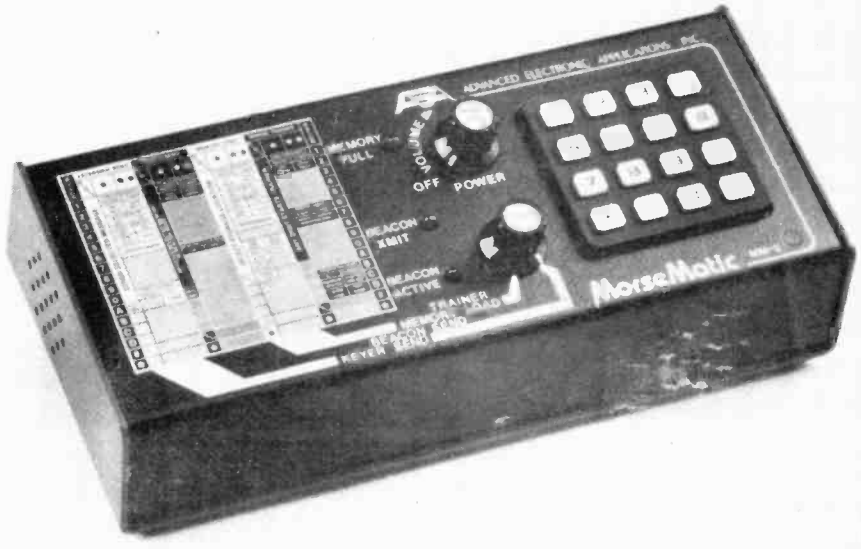
A final thought is that many East European stations are still stuck with CW only on 144MHz and if you want to work SP and HG on this band you'd better

STARTING FROM SCRATCH

polish up your CW or you'll remain hungary for them (oh gawd, he's still at it. Where's the humane killer? - MD)

The other time you'll really have to use CW if you want to work the DX on 144MHz is when there's an auroral opening. SSB does sort of work if the Aurora is a good one but if you're the average station not situated in Caithness or somewhere the average aurora doesn't produce rock-crushing signals and SSB can be pretty well impossible to copy because of the Dopler shift. However, CW is dead easy. What happens is that instead of sounding like a pure tone you hear something which resembles keyed white noise - it's a bit strange the first time you hear it but it's no problem to copy and if you just net on what seems to be the loudest bit of the noise you'll be away. Don't forget that a tone report is meaningless in an aurora - well, yes, we know it's meaningless most of the time anyway but never mind - so you don't send 9 or whatever, you send A for auroral. So a report to a station you're working off an aurora might be 55A.

Rightyo - goo luck and we'll see you down the bottom end of 144MHz! A final thought - if you hear some DX on 144MHz who's quite strong but who isn't hearing you because his Rx is a bit tired or he's running much more power than you, try calling him on the key if he has the appropriate licence. We have lots of contacts this way if we haven't got the big linear on or we're testing a rig on its own or something, and it's often good fun too!



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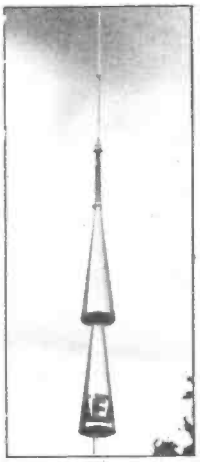

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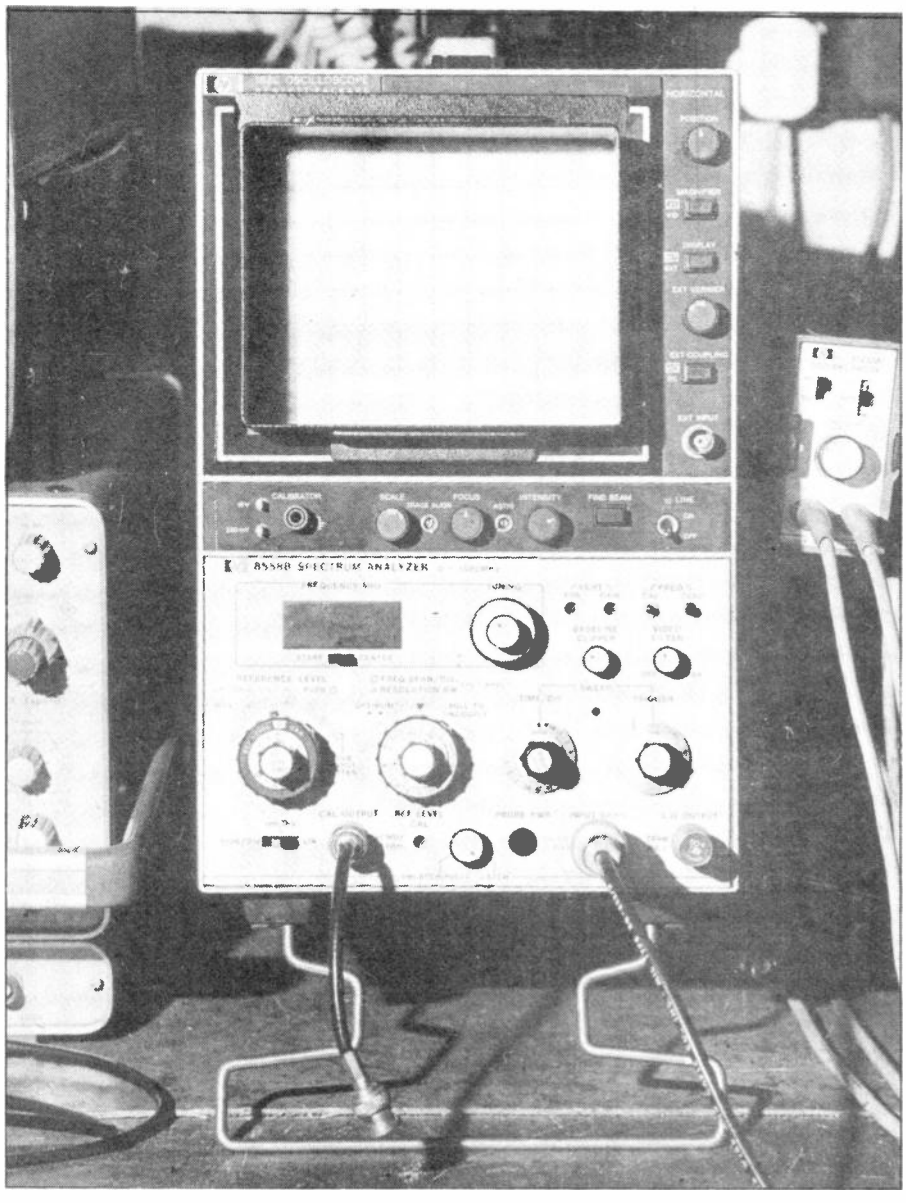


From the lab to the shack

Angus McKenzie G30SS continues his voyage through the stages of amateur radio equipment. This month he starts on the transmitter 'chain', and examines microphones and microphone circuitry.

There is, unfortunately, a lot of confusion about types of microphone, impedance and matching with rigs, so let's have a look at microphones and interfacing problems. There are three main types now sold either with rigs or as accessories; moving coil, crystal or ceramic and electrostatic types. I am ignoring carbon microphones which fortunately are not normally supplied now!

A moving coil microphone is the opposite of a moving coil loudspeaker. The acoustic energy arriving at the diaphragm is converted into an electrical output by a coil, which is wound round a former behind the diaphragm, moving across a magnetic field. Depending upon the impedance of the coil, the output voltage varies. This voltage directly relates to the number of turns or to the square root of the impedance. Some moving coil mics have a step up transformer in them, with a choice of impedances on the secondary. Thus moving coil mics can have output impedances as low as 30 ohms, or as high as 50k.

High impedance

Crystal and ceramic mics have a very high source impedance, mainly capacitive, so they need to work into a rig having an input impedance in Megohms rather than kilohms. If such mics are loaded by a rig having substantially less than 1M input impedance, then very severe low, and even middle, frequency cut will be apparent and the quality will be extremely thin. For this reason the mics should be avoided unless a preamp is available specially for them.

Electrostatic microphones, known as capacitor or condensor mics, either have a fixed charge built in to them (this type is known as an electret) or a charge voltage is obtained from a voltage source. This may be an inverter working from a battery, or a voltage within the rig. Electrostatic microphones convert an acoustic sound pressure level to an output voltage by the sound pressure causing a variable capacitance to be produced within the diaphragm. This varying capacitance causes the voltage to vary, because the charge remains constant. The diaphragm presents an extremely high impedance, of hundreds of Megohms, so the first stage is usually a very high impedance FET. The output from the built-in preamp is usually low impedance. Electrets can often have quite a low output level, although this need not be so on a well designed mic. Let's have a look at the good and bad points of each of the types.

Moving coil mics, as supplied for amateur rigs, are reasonably omnidirectional, although high frequency sensitivity will normally be best head on. If the diaphragm is reasonably small, the output quality will normally be dependent upon the acoustic qualities of the housing, which explains why many cheaper hand mics have a rather tubey or hollow, coloured sound. A studio quality moving coil mic can be excellent, but such mics are very expensive indeed.

Some noise in the background

Unfortunately moving coil mics have a nasty habit of picking up hum from power supplies, mains leads or even Gorgonzola cheese, anywhere near the mic, so you have to watch out for this. You should normally choose a moving coil mic having a lower source impedance than the input impedance of the rig, so that a 600 ohm mic would work well into say, 2500 ohms on the rig. Often, in an attempt to avoid confusion, a microphone impedance is quoted which is actually the recommended load impedance rather than that of the mic iself. If you use a mic of low impedance into a much higher input impedance, there should not be any trouble, although you will have to wind up the mic gain somewhat, and you may suffer some noise in the background by doing so. On the other hand, if you use a high impedance mic into a low impedance rig, you will find that not only will the level be very severely attenuated, but the response may well go haywire.

Crystal and ceramic mics give a voltage output by their diaphragm squeezing an element, which when squeezed, gives an electrical output. They are more trouble than they are worth, and are inclined to produce very nasty ringing noises towards the top of the transmitted frequency range. Digressing for a moment, I well remember a station in Central London 20 years ago, who used such a mic and had an incredibly noisy parrot in his shack. Every time the wretched thing squawked, the noise hit a microphone peak which spread over the entire 2m band! We all knew when he was on by these characteristics!

..an incredibly noisy parrot in his shack...

Electrostatic mics can give a very smooth reproduction quality, and are usually omnidirectional when supplied for use with communication equipment. Unfortunately, in order to make them more robust, they often have thicker and tighter diaphragms, which tend to cut LF very badly, and too many electrets give a very thin sound, although they can amazingly clear and clean at best. Better quality electrets, or normal capacitor mics, are extremely expensive, superb in performance, and have a much smoother response, but are much more easily damaged.

Even hot breath near them causes problems, including a lot of LF noise.

At this stage I want to have a long moan about the disgraceful lack of standardisation of microphone inputs to rigs, both in terms of sensitivity/ impedance and socket pin configurations. For 10 years now, Trio, Icon, Yaesu and others seem to have each been battling out their interconnection standards, so that mics of the correct sensitivity and impedance cannot be interchanged between rigs, even if these use the same sugs and plockets. I use these new words as the socket has pins and the plug has holes! This is the first infuriating problem, in which the PTT line live and earth pins and the microphone audio and earth can be completely incompatible. Now, matters are even worse, for we are seeing seven pin, eight pin, and even more complex interconnections on mics and rigs which make it almost impossible to swap mics between rigs. Some rigs provide a pin with audio on receive for use with a loudspeaker mic, whereas others don't have this facility. What is even more infuriating, is that after studying a rig's destruction bok, you find out that some mics for use with the rig have built in preamps whilst others do not.

It would be very useful if some small British Company made a series of adaptors

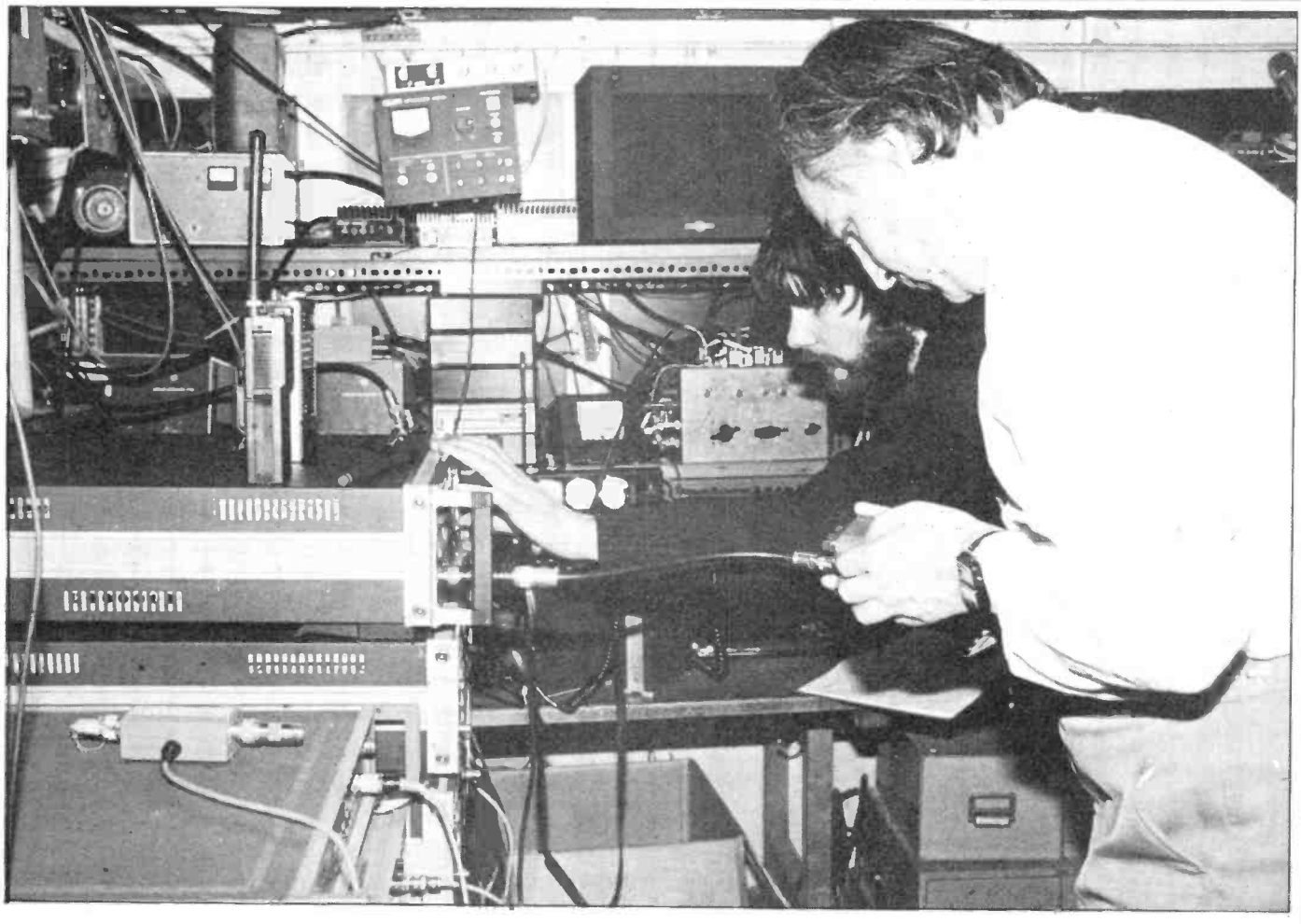
Amateurs who have many rigs around, and who like to try different mics have found this whole situation absolutely infuriating, and I earnestly request manufacturers and importers to develop a standard as soon as possible in order to stop this ridiculous nonsense. It would be very useful if some small British company made a series of adaptors allowing, for example, Trio mics to work with Yaesu or vice versa. Of course you can make one up for yourself, but this all takes time and energy which many of us do not have.

A few words on using microphones may be of help. Some people have a habit of attempting to eat the front of the mic when talking. This leads to very bad 'P-blasting' etc., as well as rather nasty reproduction. On the other hand other stations, many of whom seem to be in Southern Europe, speak about a yard (or a metre?) away from the mic, turn the mic gain right up, and then shout. The resulting reproduction is incredibly 'bathroomy', and reduced readability results. Some shacks have a very dead acoustic, particularly if they are carpeted and there are heavy curtains around, whereas other shacks can produce an ambience resembling a tube station acoustic. I have found that for communication purposes, the optimum distance is between 8 and 16 cm from the mic. If you have to work closer than this, which you may well have to when mobile, then speak across the front of the mic rather than into it.

If you are using a mic with built in PTT, but without a 'lock-on', then you may suffer from 'sore thumb syndrome' on a long over. This eventually leads to the thumb twitch characteristic which is reproduced the other end as continuous bumping and squeaking noises as the PTT lever scrapes around as the thumb becomes more and more feeble. As blood begins to seep away, the twitching becomes more severe! For this reason, why on earth cannot most PTT mics have a click position for locking. I know long overs can sometimes be a menace but if you are working duplex, the PTT requirement becomes a considerable nuisance.

RF pick up

Very frequently, there is radio frequency pick up on the mic leads and input circuitry, especially when an HF rig is used to drive transverters and linears. In the past, many manufacturers did not take such use into consideration, but I must admit that most modern rigs are much better. Here are a few hints which may sort out some problem situations: you can try small ferrite beads on both the mic audio and PTT lines, immediately behind the mic socket. You may also find that soldering on a capacitor of around 470pF from the first base to emitter junction, or its equivalent, with as short a connection as possible, may dramatically reduce RFI pickup. Sometimes, it is also necessary to apply the same technique to later audio stages, eg.after the mic gain control. This worked wonders with a Yaesu FT101B that I used many years ago. Incidentally, sometimes RFI can be caused by a poor standing wave ratio on the leads connecting the linear up to the aerial. Improving the SWR, by one means or another, can often dramatically cut RFI pickup.



From the lab to the shack

In the lab, I have often had to measure the response of a rig with and without the microphone, injecting tones into the mic socket to see what the rig itself is like, but placing the microphone over an 'artificial mouth' for testing the mic/rig combination. The Bruel and Kjaer mouth includes both a loudspeaker and special capacitor microphone, which feeds back the received audio sound pressure level to the driving equipment so as to make the acoustic level at the point where the microphone is held, constant over the communication bandwidth. With such equipment, I have found some horrific response anomalies, including nasty peaks of 10 to 20dB within the range 300Hz to 3kHz. Other mics have had equivalent valleys and some have built in slopes of as much as 6dB/octave. A mic with a smooth response should suit almost any voice, provided the rig itself has a respectable response. Mics with response anomalies may improve the transmitted sound from some voices, but make others sound ghastly. Therefore, it is worth while trying a few different mics, which leads us back to the interfacing problems again!

Finally, I offer a few words about microphone preamplifier characteristics. FM-only black boxes usually have both a microphone gain control, and a deviation limiter gain. There is often confusion between the adjustments necessary for these two presets. The mic gain control always comes before the deviation limiter or clipper, and should be used to adjust the basic gain between the acoustic sound pressure level produced at the mic. from the user, to the deviation control circuitry. The mic gain control should not be used for setting deviation unless there is no other way. The deviation control should just alter the deviation at which no higher deviation becomes possible. Such a control though will obviously affect lower level gains, if it works in the normal way.

Some mic preamplifiers actually have built in limiters

The best way to set deviation is to make various shouting and roaring noises into the mic and adjust deviation to just below the point where repeaters will start pipping with over-deviation indications, or local amateurs start grumbling that you are spreading into an adjacent channel. In the case of SSB rigs, I suggest you adjust the mic gain so that you are on the onset of ALC, but not too far into it. Some rigs do not like the ALC being driven too hard. When a compressor or clipper is used, rather complicated setting up procedures are required in many cases in order to achieve optimum results, and I will discuss these in a future article.

Some mic preamplifiers actually have built in limiters, as part of a complete integrated circuit. Others have quite a high gain before the mic gain control, and in such cases, the mic/preamp can be overloaded by shouting too close to the mic. Input clipping margins can differ greatly from rig to rig, and so it is worth while doing a few experiments to see how much you can shout before readability is actually reduced. Remember that grossly distorted audio can not only reduce readability, but may be incredibly tiring to listen to, resulting in the offending station frequently being ignored by amateurs who will just say to themselves "oh it's that over compressed, distorted lid again!"

Sometimes it is worthwhile having a look at the input and output coupling components in the preamp. Very often the LF response is over controlled by a capacitor of too low a value, the rig being designed for use with small squeaky voices. In other cases, the transmitted sound can be too muffled, but take care if you try and get HF back again, for you may be mucking up a filter which prevents over-deviation of HF. There can be no doubt that amateurs who take trouble over choosing the right microphone, and setting up mic gain and other presets carefully, consistently put out far better quality transmissions than 'warlo' merchants!

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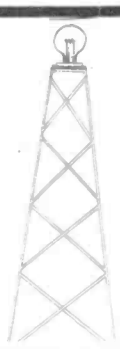

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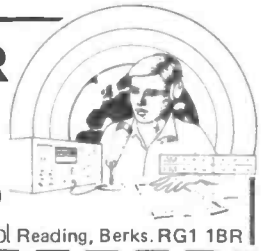

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PASS THE R.A.E.

CAPACITORS

Last time we started to look at capacitors - this month we study them in more detail. Pay attention at the back, says teacher Nigel Gresley (Sir to you!).

Righty-ho, team, back to the grindstone and more on those devices called capacitors. The word 'capacitor' is somewhat modern, and if you were to talk to an amateur of pre-war vintage, or even post-war, he'd probably look at you blankly if you said "capacitor" because he knows the component as a 'condenser'. You still hear a few people talking about condensers, actually, but for most of us the word capacitor is the one you'll come across.

Last time you'll remember that we talked a little bit about charge and one of the objects of the exercise in this part of the course is to find out how we can measure it. Perhaps we should say at this point that the concept of 'charge' isn't all that relevant to everyday use of capacitors, although from the theory point of view it's at the bottom of the how or why a capacitor works at all. However; you'll remember that we talked about the idea of connecting a couple of metal plates isolated from each other to the poles of a battery and what happened at the instant of connection, so to speak. We also said that the actual quantity of charge which could be accepted by a capacitor was proportional both to the voltage applied to it - ie. the number of volts you aplied across the metal plates in our illustration last time - and to the 'amount of capacitance' which the capacitor possesses. What do we mean by the 'amount of capacitance' please?

One electron per second would be far too small

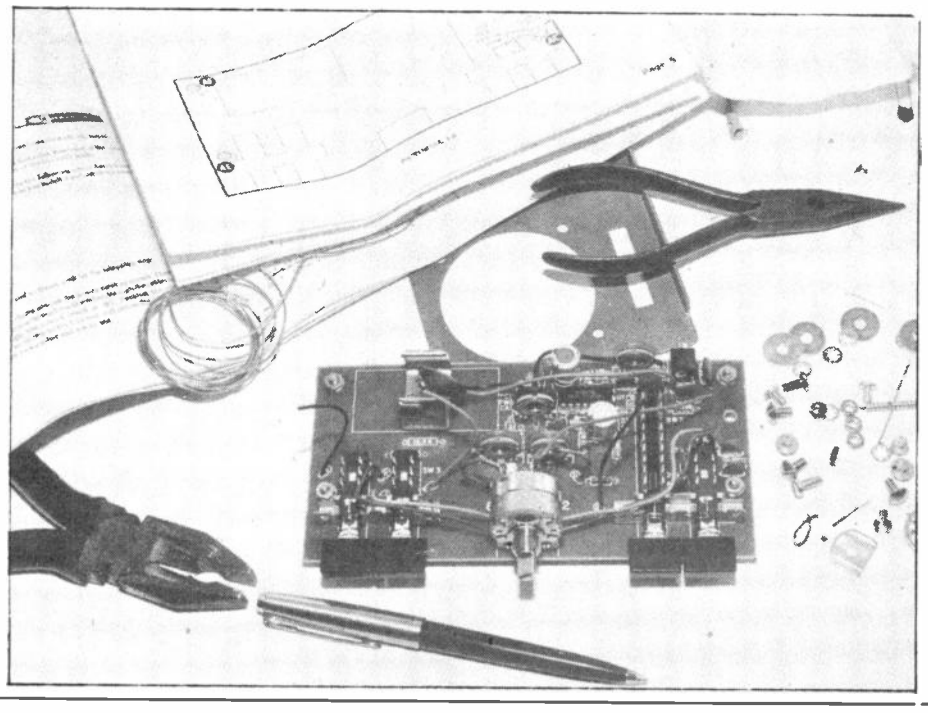
Well, as we said last time, the unit capacitance is something called the Farad and it's time to take a look at how we define it. Now you'll remember from the early days when we were defining what we meant by current that a practical unit of one-electron-per-second would be far too small, and you may also remember that a current of one amp represented an electron flow of something like 6 times 10^{18} electrons passing any point in one second. So it isn't too large a step to take the same number of electrons as the unit of electrical charge - bearing in mind that in this case we're talking about a quantity of electricity. The unit of charge is called the Coulomb, which is the number of electrons passing a given point in one second when a current of one amp is flowing. And now - wait for it - the unit of capacitance, the Farad, can be defined as the amount of capacitance which requires one Coulomb to charge it up to a value of one volt. Simple, eh?

If you wish to be all mathematical, you can express it in an equation which goes like this;

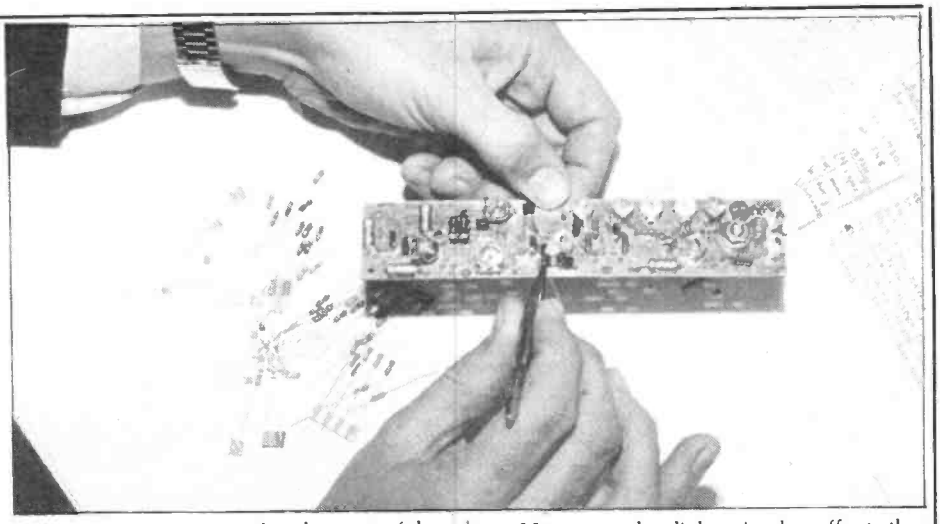
$$Q = VC$$

where Q is electrical charge, V is voltage and C is capacitance.

While we're on this tack, let's have a look at the amount of energy which a capacitor contains when charged. The physicists use the unit known as a Joule to denote a quantity of energy, and in fact if one watt of electrical power is dissipated in one second, and expenditure of energy of one Joule has taken place. The energy in joules contained in a capacitor is given by $^1/_2CV^2$, where C is its capacitance in Farads and V is the voltage to which it is charged. Just for fun, let's see how much energy is contained in, say, the capacitor bank of the high-voltage supply of a big linear amplifier - let's assume that there's 50 microfarads of capacitance (a microfarad is a millionth of a Farad, if you remember) and that it's charged up to 2.5kV. Hmmm - 0.5 times 50 is 25, times 10^{-6} (to make it microfarads), times 2500 squared, which is 6250000 - erm, that's 156.25 joules. Now then - given that the joule is the quantity of energy represented by one watt per second, what happens if we drop a screwdriver across the smoothing capacitors and they take, say, one-hundreth of a second to discharge? Well, that means that in that time something like 15.6 kilowatts is dissipated somewhere - heating up the screwdriver and making one hell of a bang would account for much of it, we feel...the point of mentioning this at this stage is just to show you that power supply capacitors for big amplifiers of some sort - hi-fi, amateur-type linears, whatever - contain an enormous amount of energy and they need to be treated with care. Don't short them out if you can possibly help it because a) it does the capacitor no good at all and b) you may well have a problem because the screwdriver or whatever may well weld itself to the capacitor terminals and you won't be able to get it off again - result,



you have to scrap both. Yes, Brian, it has happened to us! Oh, and the BANG! will frighten the dog and will also make your ears ring and your hands shake for half an hour afterwards. It will also make you swear to design-in adequate fusing into your power supplies so that the capacitors aren't asked to discharge into a short-circuit which the failure of any component might bring about. It never hurts, actually, to have a low-value resistor somewhere in the system to limit the current which flows if the worst comes to the worst and there's a catastrophe somewhere and the smoothing capacitors do get shorted out - at least the bang won't be quite so enormous!



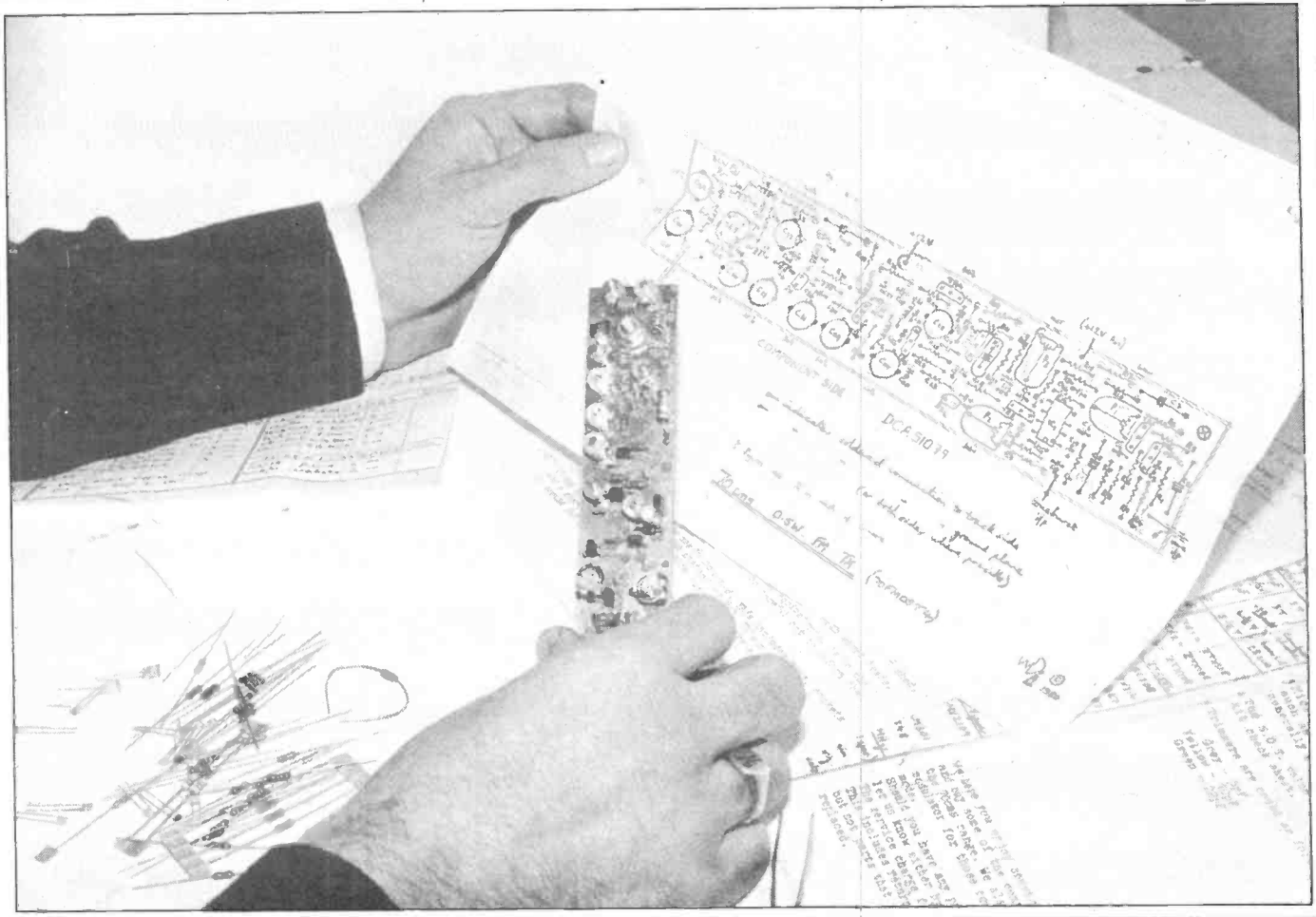
The screwdriver may weld itself to the terminals

Anyway, enough of this. Last time we touched briefly on what made some capacitors different from others, given that the essence of any capacitor is two plates which are insulated from each other. Well, it's the material which separates them; we referred to it as the dielectric in last month's spiffing instalment. You can use all sorts of things for the dielectric of a capacitor; air is used for variable capacitors but we'll come to those in a second or three. We used air in our example, but in actual fact air isn't very good in one sense because its dielectric constant, which describes how efficient a dielectric it is, is only 1. You remember that the capacitance of any capacitor is proportional to the area of the plates and inversely proportional to the distance between them, but it also depends on what material separates the plates as we've seen; another way of describing how good a dielectric material is, is by referring it to air, and if you do this you use the term relative permittivity. Try saying that down at the club after a pint or two.

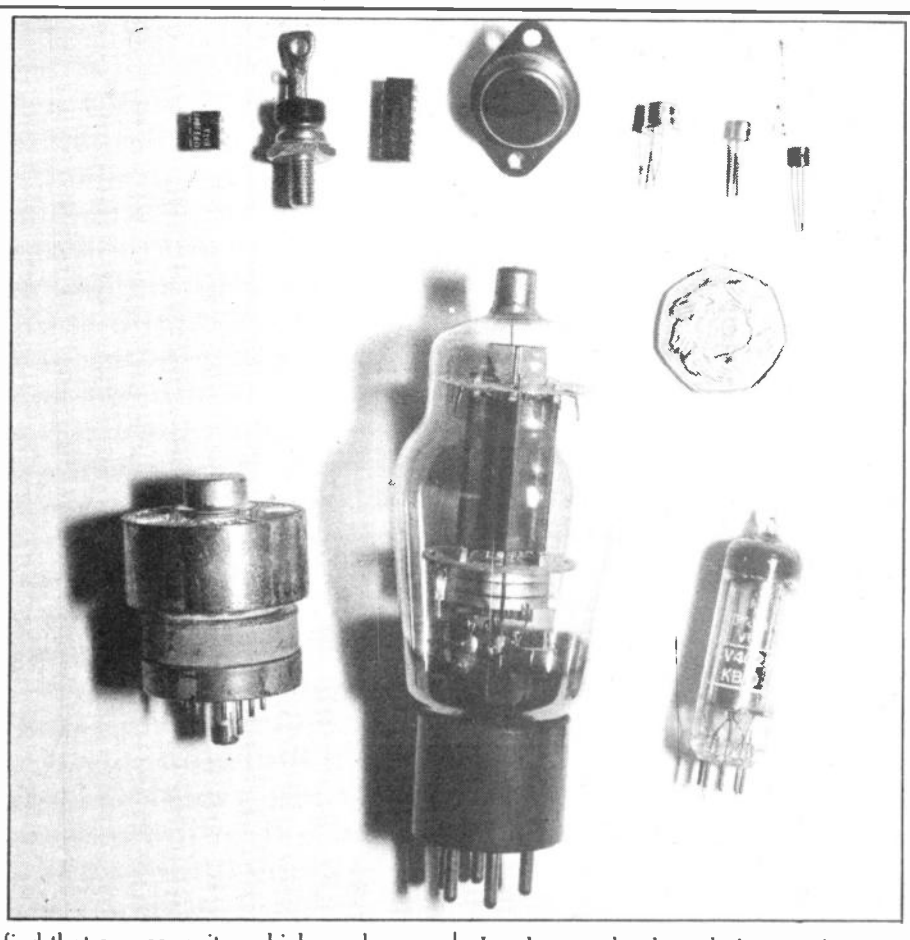
If everything is relative to air, it's obvious that air has a relative permittivity of 1. Most plastic materials which are used in actual capacitors have relative permittivities of about 2.5, and some ceramic compounds which you'll come across have values more like 15. In essence, this means that you can make a much smaller capacitor if you use ceramic or plastic as a dielectric than if you use air.

However, the dielectric also affects the frequency at which a capacitor can be used. For reasons which are a bit complicated at this stage (shouts of "copout", "windy", "down with Grease Nipple"! No, really it is a bit complex and we'll look at it when we've gone into AC theory a bit) some dielectrics don't work too well at high or very high frequencies and you'll need to choose your capacitor with care depending on what you want to do with it. Capacitors with a ceramic dielectric tend to be good to a couple of hundred Megahertz, whereas 'paper' and 'electrolytic' types are much poorer at higher frequencies and start to misbehave themselves - often not acting at all like a capacitor should.

Before we get back to the heavy figures, let's take a look at different types of capacitor. There are heaps of them,

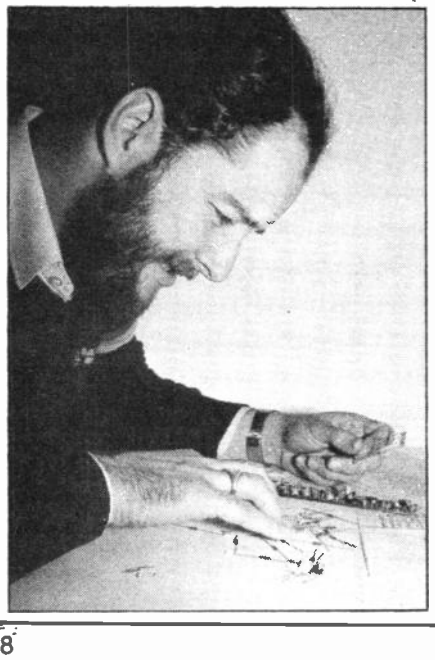


PASS THE R.A.E.



unlike the case resistors where there are only a few, and they cover a wide range of different values and you use them for different jobs. You can buy them in values of anything between about 10pF or so (the pF is the picofarad, which is one million-millionth of a farad, or 10^{-12} farads, up to about 500,000 microfarads (MF) - the microfarad being 10^{-6} Farads as we've seen. Let's start at the high end, and there's really only one type of capacitor with the higher values, ie. those between about 10 and 500,000 uF; this is the electrolytic capacitor. The plates in these are made of a foil of aluminium or, in some smaller types, tantalum (if you've never heard of tantalum don't worry - it's a so-called 'rare earth' metal from the same family as aluminium) and the idea is to have a semi-liquid compound of some sort between the layers of foil. The actual dielectric is a very thin insulating layer which is formed by the voltage between the plates - this is called 'electrolytic' action, incidentally, which is where the beast gets its name - and because this is literally a few molecules thick, the amount of capacitance which results is pretty enormous. This type of component is usually pretty large, however, unless it's a tantalum job which only come in quite low values.

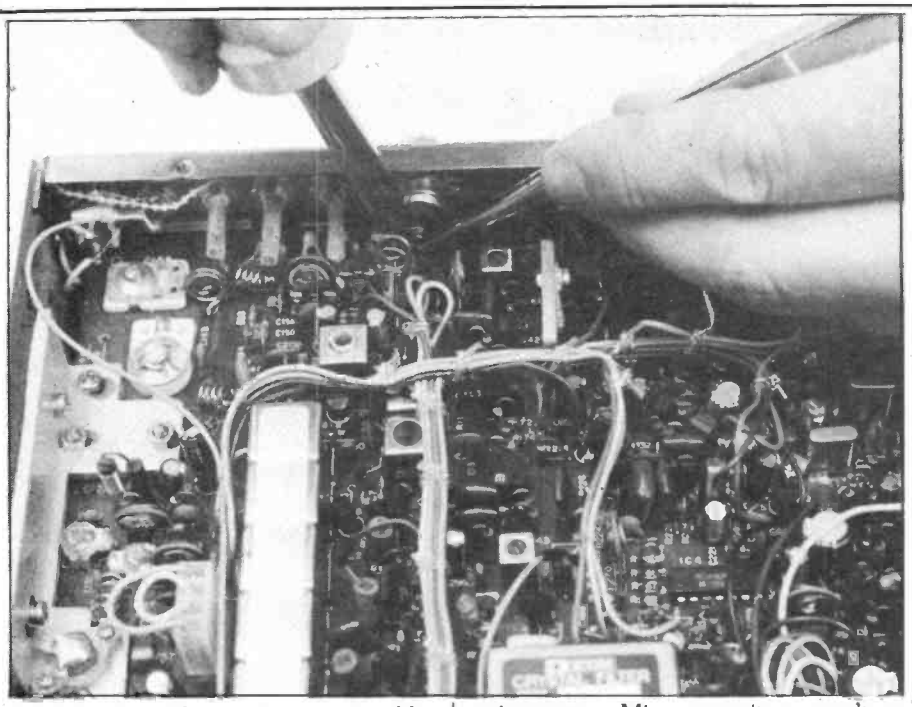
At this point, by the way, maybe we ought to mention something known as the working voltage of a capacitor. Obviously any capacitor needs to be able to withstand a certain amount of voltage difference between its plates, and the actual voltage it can stand is a function of the size of the plates and the separation between them; it's also related to the dielectric material in some cases. You'll find that any capacitor which you buy or otherwise come across has not only its capacitance specified but also its working voltage, and you need to be careful that you don't exceed the stated value. Now as far as electrolytics are concerned, and certainly the bigger ones, you'll find them used in power supplies and you'll certainly find yourself building those in your amateur career; the great thing to watch is that the voltage across them isn't too near their rated working voltage because if you go over the top there will be an enormous BANG! and something extremely nasty will happen. It will, literally, burst - and I should warn you at this point that one of the nastiest smells in the known universe is that produced by an electrolytic which has departed for another life! It really is nasty and it lingers for days, so do watch it.



One of the nastiest smells in the known universe

The other point about the voltage across an electrolytic is that without it the capacitor can't work at all; it relies on the applied voltage to form the dielectric which allows it to work in the first place. There are two things which follow from this, both of which are important. One is that the voltage applied across an electrolytic MUST be the right way round - the positive side of the supply MUST go to the terminal marked + or coloured red or whatever it is because if you get it wrong you will do the capacitor in and in all probability stink the house out again. In other words, electrolytic capacitors are 'polarised'. The other important point is that if an electrolytic isn't used for some time the dielectric tends to break up and generally cease to exist, and it needs to be "formed" again in a special way. We'll look at exactly how to do this later on, but please be careful of buying electrolytics from rally stalls and so on. If they look at all old you certainly shouldn't apply the full voltage and current to them that they look as though they'll be good for, because they're likely to get very hot and produce the usual smelly result. To re-form an electrolytic, apply the rated working voltage to it via a resistor which will only permit about 10 milliamps to flow through it; monitor the current with a suitable meter, or ask a friend to do it if you're not sure of the procedure. An electrolytic which is going to be of any use ought to take only a milliamp or two after a couple of hours of this treatment, but if the meter is still indicating a high current after this time you'd be better off slinging it away.

Okay - that deals with electrolytics for the moment. Next off the pile are capacitors with plastic dielectrics of one sort or another and these are probably the most common general-purpose component you'll come across. Names like polyester, polycarbonate, polystyrene, polyputtheketlon (no, not really) don't exactly come tripping off the tongue at the best of times but you'll get used to it - you'll find them in values of anything between 0.001 uF and 1 uF and working voltages between about 10 and 250. There are yer general-purpose bog-standard capacitors for anything which doesn't require very high frequency work



and their internal losses stay manageable until about 30MHz. Electrolytics, by the way, tend to be pretty useless about audio frequencies, which is why you generally find them confined to power suplies and such. Modern plastic capacitors, especially the polypropylene and polycarbonate types, are extremely reliable provided you don't exceed their working voltage, and you can depend on them to do a good job.

When you want to work with very high frequencies, you need to go to ceramic or mica types. Mica capacitors aren't so common now as they used to be but they're still jolly good for VHF work - they're made by interleaving several plates with layers of mica and then putting the lot in epoxy or similar. A version called "silvered-mica", where you have avery thin layer of silver on a mica dielectric, costs an arm and a leg but their stability (which means their change of capacitance with temperature and a few other things) is superb and, as we'll see when we come on to oscillators and things, that can be extremely important. However, their working voltage is often not very high and they won't handle a lot of current, so be careful where you use mica capacitors.

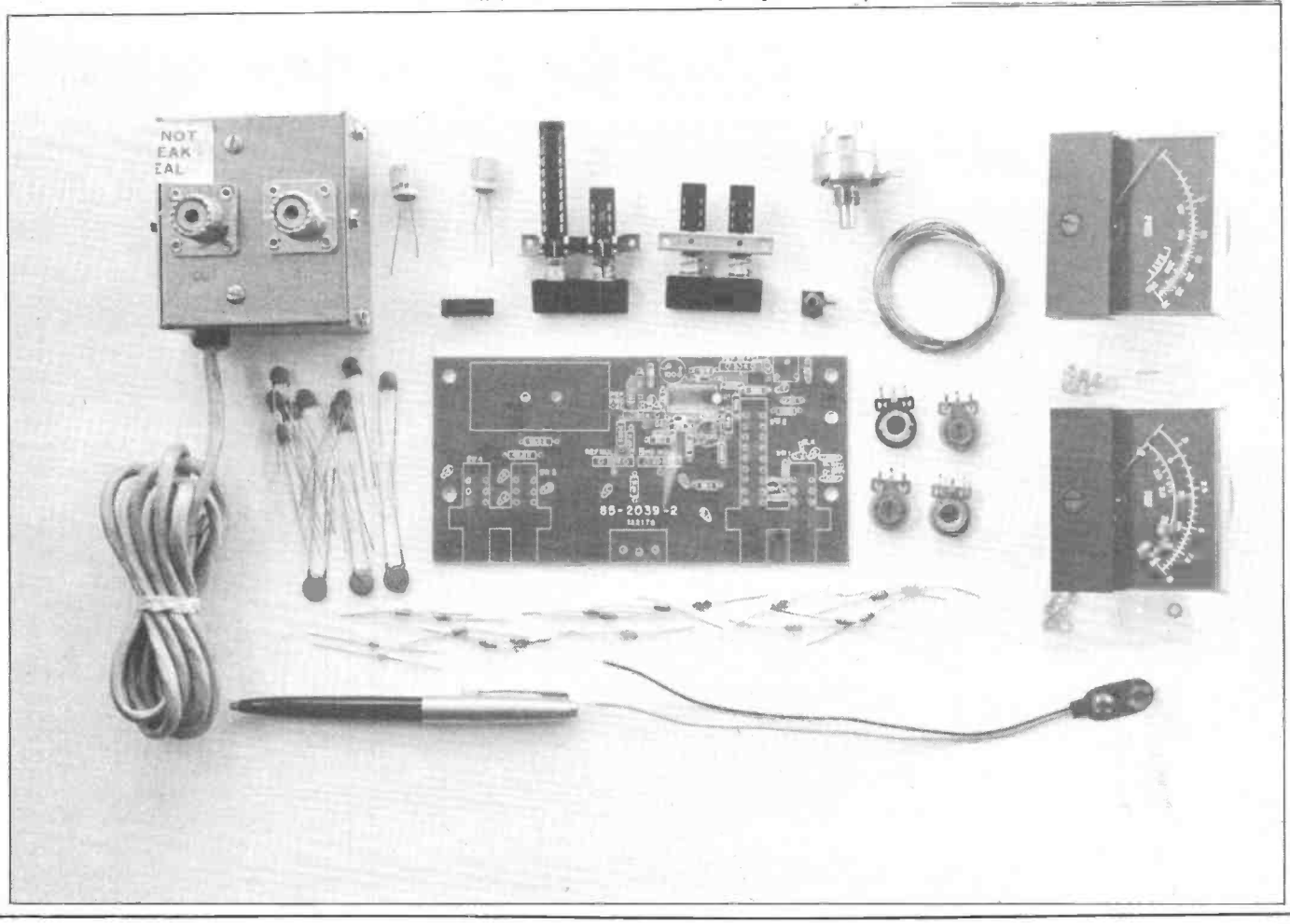
Anyway, let's leave it for now otherwise you'll get indigestion. Just a couple of nasty little questions to leave you with, just in case you thought we'd relented and decided to stop asking them! By the way, do any of you actually bother to have a go at them and follow the explanations the month after, or does no-one take a blind bit of notice? No-one's ever said anything except once, when some people thought we hadn't given enough info for a reply (we had!) How's about the odd letter to tell us whether we're wasting space or not?

Right. Question One. Your big linear has 100 microfarads of smoothing and the EHT meter says 2000 volts. How much potential energy in Joules does it contain?

Question Two. Would you use an electrolytic capacitor to take the output from a 144 MHz transmitter to the antenna?

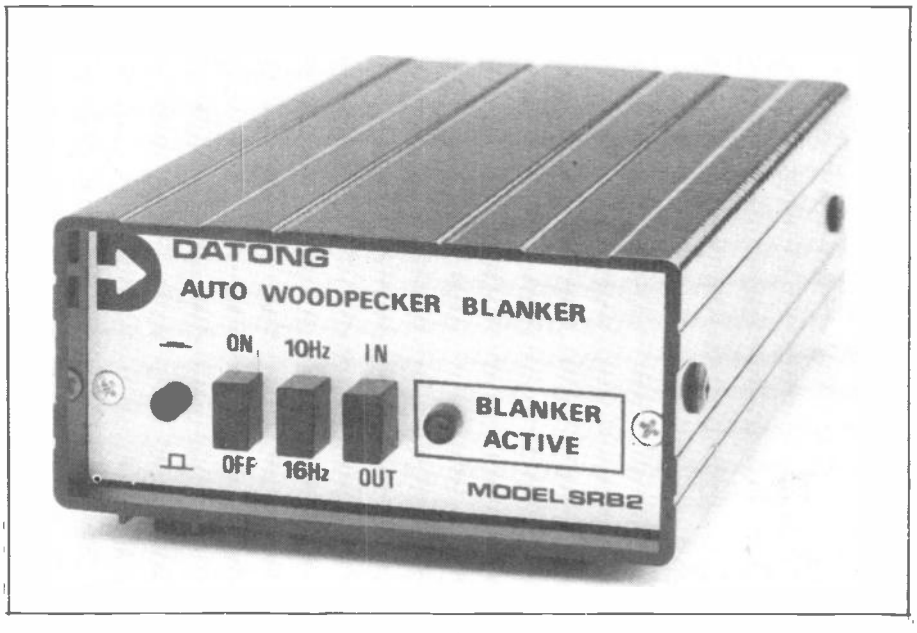
Question Three. You se a capacitor at a rally which has "100 uF 450V" written on the can and there are two terminals, one coloured red and the other black. What type of capacitor is it and what do the hieroglyphics mean? Supplementary question - if it had a date of manufacture of 1970 on it and it looked new, would you need to do anything before you used it?

See you next time.



ON TEST:

TWO FROM DATONG



By Nigel Gresley

In a way, it's a pity that a device such as this has to exist at all- mind you, for the HF man it's just as well that the clever chaps at t'mill have been at it again! We don't know quite why but Dr David A. Tong has a knack of coming uyp Tong has a knack of coming up with some off-beat piece of gear which fills a real operating need; usually either one which no-one's thought of before or one which has been done before but not in such an elegant or comprehensive way.

Wot's a Woodpecker Blanker, Brian? Well, you see, in the depths of the USSR lives a high power over-the-horizon radar which runs about 40 megawatts effective radiated power slap bang in the middle of the HF bands, usually a touch below the MUF. The beast makes a racket such as you've never heard before - the first time we heard it we thought the audio amplifier in the rig had gone unstable since it sounded just like 'motorboating' in a big way. It certainly can make the HF band which it's affecting sheer misery. The general effect can vary from being faintly tiresome to a complete wipe-out and a noise blanker of the usual sort often isn't too effective for various reasons; if the Woodpecker is very strong it often seems to overload the first mixer in the wireless and if that happens all the noise blankers in the world won't be able to do a thing about it. Admittedly the blankers in some rigs seem to cope with some Woodpecker pulses but for a real solution you really need more potent medicine.

Which is where Dr Tong's gadget comes in. His latest device is the "Model SRB-2 Auto Woodpecker Blanker", and it is basically a small box which is connected between the antenna and the rig and also between the audio output of the rig and an external speaker - the usual SO239 sockets and phono sockets are provided. It requires somewhere between 10 and 16 volts at a couple of hundred mA to do its thing, and a red LED shows when the power is applied. Another red LED shows when the blanker part of it is active, blinking away at the blanking rate. In typical Datong fashion it's very neat and well made and the internal gubbins is well put together; there's no circuit suplied with it (there usually isn't with Datong products, and in this case we guess that it's because the device is the subject of a patent application).

To start with, we took a Trio TS520, which is quite an old HF rig although still a good one we've had ours for years and it's worked like a charm, although it doesn't like the Woodpecker one tiny little bit! So we thought it would make a good trials horse, as it were. It took a few minutes to connect up and we were away.

Typically, and by the law of Professor Johann Jeremiah Sodde, there wasn't a whiff of the Woodpecker to be found at that stage! The box seemed to be working, however - there was a faint click from the innards which suggested that the internal antenna relay was switching from 'through' mode to 'ready-to-go' mode. As soon as we pressed the PTT and gave a quick "waaa-lo" the internal RF sensing did its stuff and the relay went over, or rather fell out, but when we stopped making noises it was energised again so that part seemed to work well enough. Dr Tong doesn't for some reason, indicate how much power the relay can handle and it doesn't look all that meaty, so we feel that if we were to use a linear we'd probably stick the blanker between the RF source and the boots.

Anyway, there was no Woodpecker that day; however, the next day we made a special effort and got into the office at about 0730 (groan). Sure enough, there was the Woodpecker blattering away on 14MHz at about S9 and making life extremely tiresome; so we switched on

the power to the blanker and awaited events...

Amazing! Within about a second of it being switched on, it seemed to lock on and there was a sudden silence - hey presto, no 'pecker! It was astonishing, actually, and we tuned around looking to see what happened in the presence of a signal.

Sudden silence - Hey Presto, no 'pecker!

It was a bit odd, actually. The blanker, of course, actually takes out a bite of the RF signal incoming at the chosen repetition rate (it will deal with 10Hz and 16Hz pulses, although we must confess we've never heard the Woodpecker using 16Hz pulses; jperhaps Dr Tong knows something we don't, or have we missed something?) So a 'hole' gets knocked in the signal, and the effect takes a bit of getting used to. Using slow AGC we found that a strong SSB signal sounded very odd although it was perfectly readable - almost like one of those RF-switched linears only more so - and going to a faster AGC setting made matters rather better. It was very good inded as long as the chap at the other end didn't talk too fast because if he did that you could miss a couple of words at a time. On weaker signals the device worked very well indeed because there was no way you'd have known they were there when the Woodpecker was doing its thing but they magically emerged when the blanker did its stuff.

convincing; the blanker seemed able to synchronise to pulses coming in at anything between 9 and about 11 Hz at the 10 Hz setting and about the same relatively at the 16 Hz ditto. We discovered that there was a small residual 'click' in the speaker of the rig but it was not bothering us at all. The manual mentions a couple of internal adjustments to vary the drop-out time of the relays and to change the sensitivity of the blanking circuitry but there didn't seem any need to tweak either of them on our sample.

There are odd occasions when the Woodpecker pulses sound a little different from usual - they're softer ... as though they're via a long path.

On CW the effect of large bites being taken out of the signal depended on how fast the chap was sending and whether you were feeling wide-awake enough to get the essence of the message. Overall, however, the situation was always improved when the blanker was in circuit; indeed at one point a 9V1 station at about S5 on CW emerged from what had been S9 junk, and we had a quick contact which wouldn't have been remotely possible without the machinery doing its stuff. We had to ask for our report a couple of times, however, because the blanker kept chopping the dots out at the wrong moment!

Typically, of course, the Woodpecker chose not to appear again for a while so we were forced to get hold of a fast pulse generator and simulate the thing for further tests. These were very

So the next step was to try the beast on a couple of other rigs and see how it performed in practice. Generally it did a very good job indeed for us, the only exception being one which we couldn't understand at all and, in the absence of a circuit diagram, we couldn't look into it further. There are odd occasions when the Woodpecker pulses sound a little different from usual - they're 'softer', almost as though they're coming via a long path or there's an auroral softening going on, - or maybe it's just a different pulse format - and for some reason the blanker had no effect at all on these. It didn't matter too much because under those circumstances the 'packer is a lot less shatteringly strong than it is most of the time. The really odd thing is that we couldn't synthesise the effect with the pulse generator no matter what we did to the level or to the pulse rise time unless we made it ridiculously long -far longer than the Woodpecker pulses - so whether it was something peculiar to our one, or the combination of it with the rigs we used, we simply don't know.

Be that as it may, the machine does a fine job at stamping out the Woodpecker most of the time and it seems to us that Dr Tong has done it again. We still remain intrigued as to why there's a 16 Hz setting - we get the horrible feeling that there's a British Woodpecker just round the corner which Dr Tong knows about (he probably designed it over lunch or something) and he's trying to tell us something! Or perhaps it's a Syledis blanker - now then, there's an idea! "Dear Dr Tong, I have this wonderful idea for a Syledis blanker, the usual commission please". Seriously, it's a very good device indeed for the HF man plagued with the nasty paranoid Russian device and we can recommend it wholeheartedly.

Here's another Datong goody which we simply wouldn't be without now; this is the automatic notch filter, Model ANF-1. Before some Clever Dick asks the obvious question, yes, Brian, that's exactly what it does; it's basically a remarkably clever filter which is especially useful for the HF operator.

Basically, it's a little gizmo in the same size box as the Woodpecker blanker we've just talked about and it's especially designed to provide an effective answer to the problem of the twits who will insist on tuning up on the frequency you've been using for half-an-hour or on which there's the father and mother of pile-ups in progress and some imbecile with an OC71 front-end tunes up at S9 + 40 just as he's giving the QSL information for the last time as the band goes out (yes it has happened to us when we were in the throes of working Chagos a while back....)

ON TEST:

TWO FROM DATONG

What the ANF does is to track itself to and fro across the receiver passband at a rate which you can set with an internal preset. When it comes across a steady tone of any kind it switches itself from "search" mode to "track" mode and whammo - it puts something like 40dB worth of attenuation in to kill the interfering heterodyne stone dead. What's more, this isn't all; if the frequency of the interfering tone drifts it'll continue to 'search and destroy' it and you won't know a thing about it unless you switch it out of circuit.

This is an exquisite system. It means, firstly, that you're not aware that the device is in circuit but as soon as a tuning-up tone or whatever, if you tune the receiver and so change the heterodyne frequency the filter keeps on tracking it. This is a major advantage over the conventional manually-tuned notch filter because of the paradox that a notch filter, if it's going to be any good at all, has to be very narow and a narrow notch filter isn't that easy to tune especially if you're trying to concentrate on something else like copying a very weak signal.

The ANF has a natty line of LEDs which tell you the approximate frequency of the tone it's notching out, which is handy. In the search mode the line continually moves up and down to let you know that it's doing it's stuff - you certainly can't bear the notch being swept over the receiver passband. It's only when the LED display stops that you know it's locked on to something.

So we very much looked forward to the tests, and we connected a power supply and the speaker to the thing and awaited results. It needs anything between 11 and 18 volts, by the way, at about 400 mA maximum. The reason for the high current demand highlights another fascinating feature of the device, which is that it contains its own internal compander and audio amplifier so that although possessing unity gain overall, the output follows the volume setting on the main rig without you having to do anything about it.

First tests were with the trusty TS520 on 7MHz, and the results were tremendously impressive. The device had no difficulty in locking on to an S9 + 30 dB tuning-up session from an Italian station and more or less completely removing it. Equally, it would sometimes lock on to tones or something which we couldn't hear and which must have been below the noise level - we put this to good use later, as you'll see.

The ANF also has a 'peak' function, which makes for a very good narrow CW filter. It's best to use this in the manual mode instead of automatic (you can take manual control of the notch if you want, in cases where the filter has locked onto one tone but you'd prefer to remove another) and we found this to be very useful indeed for CW work with an IC251E which was on test at the time and which used the same filter for CW and SSB - inevitably a bit too wide for serious CW working, in other words.

Whilst doing so, we discovered something most interesting. We can't usually hear the Paris beacon, FXOTHF on 144.895 MHz, at this location - it's a bit below noise and when we do hear it we know that conditions are likely to be up that way. While we were messing about with the 251E and the ANF, we thought we'd have a look for the Paris beacon to see what conditions were like; as it happened, they were about average and we couldn't hear it at all in the speaker.

Just for a laugh, we switched the ANF back on to see what it did - imagine our surprise when after a couple of sweeps it locked on to something! It held the lock for about ten seconds and then lost it, re-acquiring it after about another ten seconds and then losing it again after the same time - weird. It suddenly occured to us what might be happening - the ANF was locking on to the space frequency from the beacon and then, when it went to "mark" for the first character of the callsign it lost lock and couldn't follow the keying fast enough to get it back. However when the beacon finished its callsign and reverted to sending space, the Datong locked back up to it. Remember that this was a beacon which we couldn't hear in the speaker! Full of curiosity, we rang a friend of ours with a better site in that direction and asked him to relay the beacon signal down the landline to us to prove the point - yes, folks, the Datong was detecting the beacon whose signal was below noise level in the receiver, which is quite an achievement.

Just for fun, we switched it to peak and tried to see if the reduction in bandwidth in peak mode would enable us to hear anything, but it didn't.

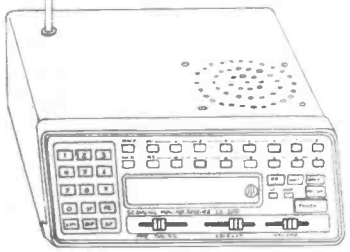
So the next step was to tune to GB3VHF and see how long it took for the ANF to lock up to the keying and remove it. The answer is that you got a quick "chirp" from the beacon keying before it got zapped by the ANF and that was that - it seemed as though the notch depth must have been at least 40 dB and that its response time was very short indeed.

Which is what we found in the lab, except that the notch depth was nearer 50 dB than 40 from the clever state-variable filter and the typical acquisition time was about a fifth of a second. There are a couple of internal tweaks, one of which varies the sensitivity of the unit and sets the notch threshold, but in the light of the performance on the French beacon we couldn't see that you'd need any more sensitivity. Datong say that the tracking rate slows down if you set the threshold too low, and we found this to be true, but at the setting which was capable of taking out the Paris beacon the tracking rate was perfectly OK. By dint of come tricky measurements we found that our sample could lock up to a signal about 8dB below the noise level of the receiver, which is a tremendous performance.

After trying it for a few weeks on the HF bands we were absolutely sold on the device. You tend not to notice it after a while but you certainly do if you happen to notice that the LED display has stopped sweeping and is sitting stationery - if you then switch the device out of circuit you're liable to hear an S9+ heterodyne which is completely drowning the signal you were happily listening to! For the HF bands man we can't recommend this machine enough and it would also be useful to the VHF man whose CW filtering isn't completely drowning the signal you were happily listening to! For the HF bands man we can't recommend this machine enough and it would also be useful to the VHF man whose CW filtering isn't all it might be; the notch will take out the occasional QRM on VHF as well. Verdict overall? Superb - nice one Dr T.

GAREX (G3ZV1)

SX200-N



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WOOD & DOUGLAS

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TV Products			
Receiver Converter (Ch 36)	TVUP2	26.95	19.60
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CLUB NEWS

Tell others about what's happening in your club - give us the information and we will try and print it here.

Axe Vale

The Axe Vale Amateur Radio Club meets on the first Friday of every month at the Cavalier Inn, Axminster at 7.30 p.m. They hold regular talks, construction evenings and visits to places of interest.RAE classes are held at Seaton. Further details are available from Peter Reach G3GOS on Axminster 34259.

Bath

The Bath and District Amateur Radio Club meet every other Wednesday at the Englishcombe Inn, Englishcombe Lane, Bath at 7.45 p.m. Details from Trevor Whitehead (PRO) on Bath 319150, or Mike Mason (Secretary) on Bath 311046.

Bury

The Bury Radio Society meets each Tuesday evening at 8.00 p.m. in the Club Room at the Mosses Youth and Community Centre, Cecil Street, Bury. Main meetings are on the second Tuesday of each month. On 8th November they have a talk entitled ***Japanese Morse*** by Norman Kendrick G3CSG.

Cambridge

The Cambridge and District Amateur Radio Club has the following activities lined up for November at it's weekly meetings held each Friday at 7.30 p.m. in the Visual Aids Room, ground floor, Coleridge Community College, Radegund Road, Cambridge:
Nov 4: informal meeting, Morse class, on air.
Nov 11: film show.
Nov 18: informal meeting, Morse class, on air.
Nov 25: talk by Ray Flavell on ***A Guide to Propagation.***

More details about the Club are available from David Wilcock G2FKS, on Cottenham 50597.

Devon Radio

The Third Devon Radio Rally is to be held in Bradworthy Memorial Hall (near Holsworthy) on Saturday November 5th between 10.30am and 5.00pm. There will be a bring and buy stand etc, and a talk-in on 2 metres (S22) G8MXI. Information from K. Nicholls, G8MXI, of Flexbury, Bradworthy, Holsworthy, Devon.

Edgware

The Edgware and District Radio Society meets at 145 Grange Hill Road, Burnt Oak, Edgware on the 2nd and 4th Thursdays of each month at 8.00 p.m. (except for 2nd Nov, which is a Wednesday. Then they have a visit to the British Aerospace Club at Hatfield.) On 10th November they have an informal meeting.

Fareham

The Fareham Radio Club meet on Wednesdays at 7.30 p.m. at the Porchester Community Centre, room 12. The November programme is:

Nov 2: natter night/on the air.
Nov 9: ***QPR Operation*** by G3CCB.
Nov 16: natter night/on the air.
Nov 23: ***SSTV*** by G8VOI.
Nov 30: natter night/on the air.

More details are available from Brian Davey on Fareham 234904.

Glenrothes

We have few up to date details on the Glenrothes and District Amateur Radio Club, but apparently several members have a net at 7.00 p.m. daily on 28.500MHz.

Harrow

The Radio Society of Harrow holds its meetings at the Harrow Arts Centre, High Road, Harrow Weald at 8.00 p.m. Bar/coffee/biscuits etc available. Dates:

Nov 4: practical and informal evening.
Nov 11: annual dinner.
Nov 18: practical and informal evening.
Nov 25: talk on computer aided design systems for printed circuit boards.

Inverness

Bob Irwin is the Secretary of the Inverness Amateur Radio Club, and he tells us that they meet every Thursday at the Cameron Youth Club, Planefield Road, Inverness at 7.30 p.m. Present projects include a power supply unit and a 2m transceiver. Morse classes are also held each week. For further information contact Bob on Inverness 221056.

Kent Repeater Group

The Kent Repeater Group has been going since 1974 and now looks after five repeaters: GB3KN and GB3KS on 2m, and GB3NK, GB3EK and GB3CK on 70 cm.

Running repeaters is an expensive business, and contrary to what some people seem to think they aren't provided by the State! So if you're a regular user of one or more of these machines, why not join the Group and do your bit towards keeping them going? Details from: Martin Stoneham G4RVV, 8 Darenth CLose, Herne Bay, Kent CT6 7EX.

Kidderminster

The Kidderminster and District Amateur Radio Society gathers on Tuesday evenings at 8.00 p.m. at the Aggborough Community Centre, Hoo Road, Kidderminster. Morse classes are held on Wednesday evenings. Details from Tony Hartland G8WOX (Secretary) on Kidderminster 751584 (after 6.00 p.m. please).

Lincoln

The Lincoln Short Wave Club has RAE and Morse classes on 2nd, 16th and 20th November. On the 9th there is a talk on aerials by G8CTG. November 23rd is an activity night/night on the air.

Magherafelt

The Magherafelt Amateur Radio Society meets at 12 Garden Street, Magherafelt on the first Tuesday in each month, and a varied programme of events is being planned for the coming season. Morse classes are held each Tuesday evening and an RAE class is held in the local Technical College on Monday evenings.

Visitors and new members are most welcome. Further details and programme are available from the Secretary, Jack Chapman (G14LVC), Tel: 0648 32096.

Maltby

The Maltby Amateur Radio Society meets every Friday evening at 7.00 p.m. at the

Methodist Church Hall, Blyth Road, Maltby, Rotherham. The Club has a regular Morse class and a computer enthusiasts' corner.

Dates for next month are:
Nov 4: ***Amateur Photography.***
Nov 11: project night.
Nov 18: visit by RSGB Regional Representative, D. S. Smith G4DAX.
Nov 25: ***Music Synthesis.***

For more information, get in touch with Ian Abel G3ZHI on Rotherham 814911.

Microwave Society

This society was recently formed to cater for those interested in microwaves, especially in the bands above 10GHz.

An excellent data pack is produced which assumes no knowledge of microwaves and gives the newcomer all the information he needs to build and operate a system. Details are given of some excellent sites and also information on where to obtain the bits. There is a newsletter called 'Waveguide' with up to date society news, and pages for the data pack, so increasing the information available to members. Excellent test gear is available to members in the event of problems being encountered.

The society has organised several events including the trip to Axe Edge recently reported in this magazine. It is hoped to organise regional meetings during the Winter months and there is a very full programme of club talks. The society will be exhibiting at the Leicester show.

For full details of the society, please contact: Glen Ross G8MWR, 81 Ringwood Highway, Coventry. Telephone: Coventry 616941.

Newbury

The Newbury and District Amateur Radio Society meets monthly (2nd Tuesday of the month) usually at Newbury Technical College.

CLUB NEWS

On 8th November they have a talk: ***Long Yagis - Facts and Fallacies*** by Dr. Ian White G3SEK.

North Bristol

The North Bristol Amateur Radio Club meet at SHE 7, Braemar Crescent, Northville, Bristol. Dates for November are:

Nov 4: Committee meeting and natter night.
Nov 11: junk sale.
Nov 18: Horizon Electronics open.
Nov 25: ***Ten metre FM Operating*** by John Everingham G4TRN.

North Yorkshire

The North Yorkshire Amateur Radio Society hold their meetings on Wednesdays at 8 pm at the Bradshaw Tavern. Further information on how to join or forthcoming events can be obtained from Brian Aspinall G6CJL on Bradford 834442. The NHARS also have a splinter group at Keighley meeting on the last Tuesday in every month at the Globe Inn, Parkwood Street.

Peterborough

The Greater Peterborough Amateur Radio Club has a junk sale/quizz/natter evening lined up for 24th November. They also have a club net on Monday nights at 8.00 p.m. on 21.200MHz or thereabouts.

Stevenage

The Stevenage and District Amateur Radio Society meets on the first three Tuesdays of each month at: T. S. Andromeda, Fairlands Valley Park, Shephall View, Stevenage.
Nov 1: ***Slow Scan TV*** by G4BWU.
Nov 8: constructors' evening.
Nov 15: talk on Navigational Satellites.

Morse classes are held before each meeting at 7.15 p.m. and there is a weekly clubnet on Sundays at 7.00 p.m. on 145.250MHz FM. Further details are available from the Club's Secretary, Cliff Barber G4BGP, on Baldock 893736.

Stockton

The Stockton and District Amateur Radio Group meet every Wednesday at 7.30 p.m. in the Billingham Community Centre. RAE classes, construction evenings and visits by guest speakers are among their activities. Membership is 50p and entry to meetings costs 20p.

Stourbridge

The Stourbridge and District Amateur Radio Society normally meets on the 1st and 3rd Monday of each month.
Nov 7: informal meeting.
Nov 21: main meeting, annual surplus sale.

The Society meets at The Garibaldi, Cross Street, Stourbridge at 8.00 p.m.

Swale

The Swale Amateur Radio Club meet
Nino's Restuarant, 43 High Street, Sittingbourne. More details about the club can be obtained from B. Hancock G4NPM on Minster 873147.

Thanet

The Radio Club of Thanet meets on the 2nd and 4th Tuesday of the month at the Grosvenor Club, Grosvenor Place, Margate at 8.00 p.m. with a Morse class at 7.30 p.m.
Nov 8: social evening and presentation of cups.
Nov 22: ***National Field Day*** by G3LCK.

Club nets are on 28.4MHz at 9.30 a.m. on Sundays, and on 145.575MHz (S23) at 8.00 p.m. on Thursdays.

Thornton Cleveleys

The Thornton Cleveleys Amateur Radio Society's fixtures are:
Nov 7: ***Modern Heating Controls*** by G8KBH.
Nov 14: ***Computers*** by G3GIY.
Nov 21: Club operating night.
Nov 28: ***Small Bore Rifles.***

Vale of the White Horse

The Vale of the White Horse Amateur Radio Society (VOTWHARS?) meets at The Canteen and Social Club, Milton Trading Estate, Milton, Nr. Abingdon. On 1st November they have a talk by G4GDU of Mutek Ltd.

Club nets: Thursdays 7.30 p.m. 28.750MHz and Sundays 8.00 p.m. 145.200MHz.

THE SPARK TRANSMITTER

Early transmitters looked and sounded like some fiendish contraption from Frankenstein's Lab! By Leonard Moss.

The earliest form of wireless transmitter was the Spark set. It had been known for many years that the passage of an electric spark produced electro-magnetic or radio waves, and the practical exploitation of this phenomenon led to the development of the spark transmitter. As a telegraphy transmitter it was in daily use for some fifty years, from the late nineteenth century until its prohibition by international agreement in 1940.

In its earliest form the spark transmitter consisted of a ten inch induction coil in which the oscillatory circuit of coil and condenser was connected across the spark gap. In turn this coil was inductively coupled to the aerial allowing the waves to be radiated into space. At first the spark gap was joined directly in series with the aerial, and the condenser which was charged up to the discharge voltage was the natural capacity of the aerial itself.

This method, known as "plain aerial", was very unsatisfactory for two main reasons. Firstly it resulted in a heavily damped wave because of the high resistance of the spark gap leading to shock exitation of nearby aerials and making any selectivity well nigh impossible. Secondly with the "plain aerial" system the main HT was connected directly into the aerial, thus rendering the aerial lethal to anyone coming into accidental contact with it. Further, unless the aerial insulation was very good, no spark could be obtained.

During the early years of this century a method of producing spark signals was developed which was to last to the end of the spark era. This was the alternator and transformer method. Consider the diagram; here we have an alternator supplying AC at a certain frequency. This AC flows through the primary of the transformer via the Morse key, and might be called the low tension circuit.

When the key is pressed, the current from the secondary of the transformer will be small but at a high voltage, and at the same frequency as the alternator. The high EMF from the secondary charges the condenser to such a voltage, that eventually this voltage will be high enough to break down the insulation of the spark gap and jump the gap. The high resistance of the gap having now broken down, the condenser is able to discharge through the primary coil and the now conducting spark gap in an oscillatory manner, the frequency of such oscillations being dependent upon the LC value of the primary circuit.

This action occurs once every half cycle of applied AC from the alternator, giving two sparks per cycle of AC. This was known as the "spark train frequency", and upon this frequency depended the pitch of the note in the receiver phones.

...rendering the aerial lethal to anyone coming into contact with it...

In practise the width of the spark gap was set at such a distance that the condenser voltage would be sufficient to break down the gap just before the condenser reached its peak value. The time during which oscillatory action occurs is very small compared with the time taken for one cycle of AC from the alternator. When the insulation of the gap is broken down and HF oscillatory current flows across the gap the intense heat of the spark ionises some of the metal of the gap forming a conductive bridge from one electrode to the other. When the gap becomes conductive, arcing takes place.

The current from the transformer secondary which has been charging the condenser will be able to flow across the gap. The condenser is now short circuited by the conductivity of the gap, preventing the condenser from recharging, and thus bringing to an end all HF oscillations. It was therefore imperative that the gap be cooled imediately after the passage of the spark, and the insulation of the gap be restored. Various methods of rapidly restoring the insulation of the gap were devised. This process, known as "quenching", was achieved in two ways. One by the use of a "rotary gap", and two by means of a "quenched gap"

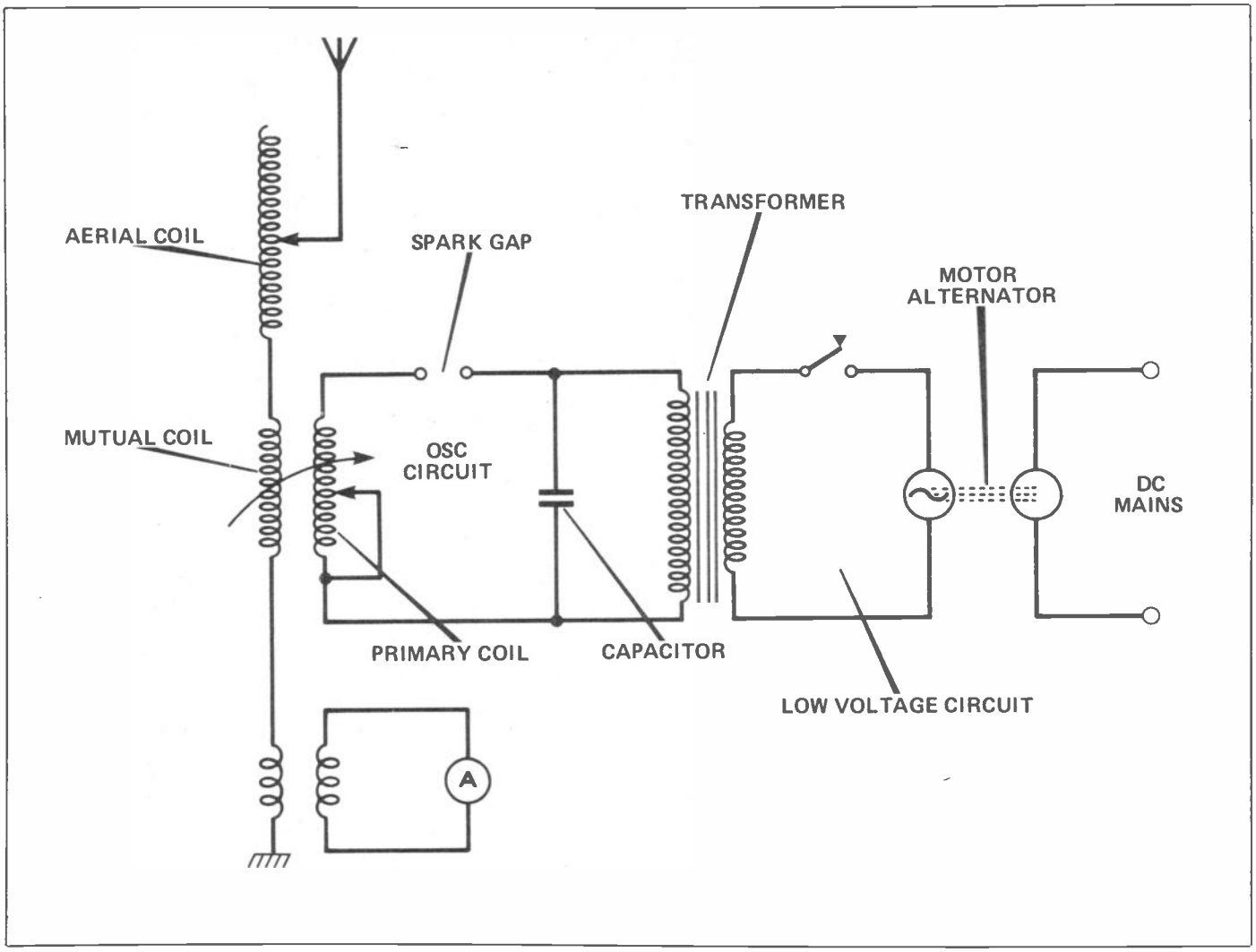
There were two forms of ratary gap. In the first type known as the "synchronous gap", a metal wheel carrying a number of studs which projected from its edge, rotated between two fixed electrodes. This rotating disc was secured to the alternator shaft. When the wheel studs are opposite the fixed electrodes the spark passes from one electrode to the wheel stud, through the wheel, and back through the second stud to the second electrode. Both the speed of the wheel and the alternator frequency depend upon the speed of the motor driving the attenuator. Therefore the number of times per second at which the condenser reaches peak voltage, and the number of chances it has of discharging can be made equal; the position of the studs being so arranged that these conditions occur simultaneously.

The spark passes from one electrode to the wheel stud

As the number of cycles per revolution of the alternator equals the number of pairs of its poles, and as in one revolution of the wheel it can be seen that to get one spark per half cycle, the wheel should have as many studs at the alternator has poles. In practise the position of the fixed electrodes could be altered by mounting them on a moveable rocker. The condenser would thus attain peak voltage when the studs were directly opposite an electrode. The width of the gap was adjusted so that breakdown occurred just before peak voltage of the condenser. Quenching was achieved and arching prevented by the cooling effect of the rapidly revolving wheel.

The higher note offered some advantages

In the case of the "asynchronous gap" the same principle of rotating disc with studs was used, but instead of the disc being secured to the alternator shaft, it was driven by an independent motor. The size of the gap between the fixed and moving electrodes was reduced to a minimum. This made it possible for the gap to break down more than once per half cycle, a spark occurring whenever the gap between the fixed electrode and approaching stud was small enough for the condenser voltage to jump the gap. By this means a higher spark train frequency from a low frequency AC supply became feasible. As the note received in the phones was dependent on the spark train frequency, the higher note associated with the asynchronous gap set offered some advantages.



The "quenched gap" was essentially another form of the old fixed gap. In the quenched gap the spark gap was divided into a number of short gaps in series. The disc shaped electrodes, each roughly six inches diameter, were made of silver plated copper. A spark gap consisted of a number of such discs clamped together in the form of a sandwich, separated by mica washers roughly two millimetres thick.

The washers extended from the centre to about half the diameter of a disc. Sparking took place between the edges of the discs. Because of the large surface area of the discs adequate cooling of the gaps took place, thus preventing arcing.

Due to the almost universal use of 110 or 220 volts DC supply in earlier years, some arrangement had to be made to obtain a supply of AC. This was usually accomplished by using either a motor-alternator or a rotary converter. The output from the latter method being somewhat lower. A motor field regulator allowed the speed of the motor and thus the alternator frequency to be varied. An alternator field regulator enabled the output AC voltage to be varied, acting as a sort of power regulator. A typical marine type motor-alternator consisted of a DC motor, input 80/110 volts at 35/24 amps driving a 2kW, alternator giving about 200 volts at 10 amps and 500 cycles.

AC was led from the slip rings via the Morse key to the primary of the main transformer. Owing to the high voltages present, a magnetic key consisting of a robust keying relay was used to make and break the AC circuit, the key itself being energised by a low DC supply.

The high voltage step up transformer was contained in a galvanised tank and was oil cooler. The secondary winding was in two separate halves which could be joined in series or parallel. In the series position it delivered about 26,000 volts and 13,000 volts in parallel.

The main condensor was mounted in a lead lined box

The main condenser consisted of a number of zinc plates measuring roughly 30 inches by 24 inches spaced by a dielectric consisting of flint glass plates about one tenth of an inch thick. The condenser was split into two separate banks, the banks being readily joined in series or parallel by means of bus bars. The whole assembly was mounted in a lead lined teak box and immersed in oil, to prevent brushing and as a coolant. In the series position the capacity was about .016 uF and about .065 uF in parallel.

Together the condenser, spark gap, and primary coil made up the oscillatory circuit. This circuit was designed to cater for a certain range of LC values corresponding to the operating frequencies in use. Generally these were 300, 600, 650, 705 and 800 metres. (1000, 500, 468, 425 and 375 kcs). The primary inductance consisted of a coil of copper tubing of large surface area with well spaced turns. A moveable tap was provided so that the required amount of inductance could be selected. This adjustment together with the series/parallel switching of the condenser allowed the circuit to be tuned to the required wave length.

HF energy was transferred to the aerial circuit by means of the mutual coil. This coil similar in size and shape to the primary coil could be moved in order that the degree of coupling between primary and aerial circuits could be varied. A large aerial coil of copper tubing, to increase the LC value of the aerial when using waves longer than the natural frequency of the aerial, completed the equipment.

The various components of the transmitter were often mounted in a strong steel frame, about five feet high, by three feet wide and three feet deep. The front of the framework consisted of a polished slate panel on which were located the aerial ammeter, a wave

THE SPARK TRANSMITTER

change wheel, and various switches and fuses. The motor-alternator and spark gap were usually mounted in cupboards beneath the equipment, while the starter and field regulators were on the bulkhead adjacent to the operator.

Spark transmitters were fitted usually in three sizes, either a $1^1/_2$kW $^1/_2$kW or $^1/_4$kW set being fitted depending upon the size of the ship and the trade in which she was employed. Some shore stations and ships (particularly warships) had much more powerful sets. Under reasonable conditions, and using the large twin wire aerials then in vogue, the spark set had a daylight range of 400 to 500 miles extending to 1500 to 2000 miles during darkness. Its robust construction and simplicity gave it a high degree of reliability under all conditions. This reliability was to be demonstrated by both sides during the Battle of Jutland, and during the tragic loss of the Titanic.

The chief drawbacks of spark transmission were that it was very wasteful of power, and due to the damped nature of the emission it caused considerable interference. Moreover, owing to the high voltages involved, heavy insulation was necessary at all points. The degree of coupling between the primary and aerial circuits was also critical. if this coupling was too tight, the transfer and re-transfer of energy between the circuits resulted in the production of a double humped wave, with two frequencies being radiated, neither of which was the desired one. A coupling of only about 16 percent or less was possible if a single frequency were to be radiated.

The sound of the spark was similar to a circular saw

A further disadvantage peculiar to shipboard use was the noise created by the set. When the key was pressed, the sound of the spark was very similar in pitch and volume to that produced by a circular saw cutting through a hard piece of timber. As the wireless room was usually situated in or near to the officers accommodation, this loud noise at night or during the "sacred" afternoon siesta period was most unpopular, particularly so under tropical conditions when all doors and ports would be wide open.

The spark also tended to ionise the air in the spark gap giving rise to the production of ozone, the smell of which some people find unpleasant. Steps were taken to sound proof the spark cabinet, and it was always sound diplomacy on the operator's part to limit transmissions during the 'critical' times to a minimum.

The spark also tended to ionise the air in the spark gap

This article is written almost entirely from memories of nearly half a century ago (when the writer was himself "young sparks") and who operated just such a set of equipment along the "trade routes of Empire".

Young Sparks

In those days more than two thirds of the world's shipping had call signs beginning with the letter "G". It does not refer to any specific type or make of apparatus; nor does it aspire to being a technical treatise on the subject - but rather to being a general description of the sort of equipment then in use, so perhaps any errors and omissions may be forgiven.

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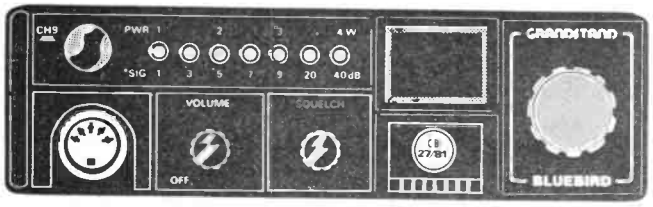

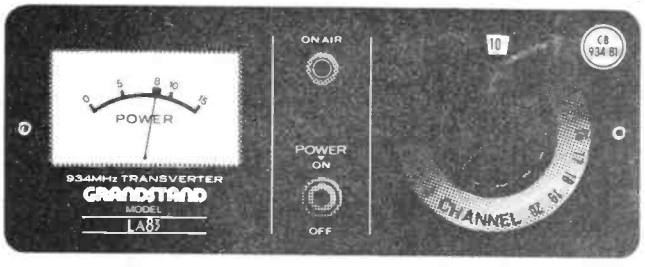

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DODSON ON THE ROAD. The fifth of a series of profiles of distributors who serve the amateur radio fraternity.

DEALER PROFILE

Peter Dodson takes to the road again to visit Amateur Radio Exchange in Acton, London. Although only in the business for seven years, Bernie Godfrey and Brenda Aptaker have built their company into one of the biggest in the amateur radio trade. Coffee is an important ingredient in their success!

If the wheels of commerce are oiled by the odd gin-and-tonic in the Chairman's office - or even a champagne lunch - at Amateur Radio Exchange it's all done with coffee! Ever since 1976 "Come and have a coffee with Brenda" has been one of the perks of doing business with a firm that, quite literally, started with nothing and grew to have a turnover of one and a half million seven years later.

It all started when Bernie Godfrey, who was in the furniture business with a warehouse in Ealing, had to move back to his Watford Head office: as a result, his secretary, Brenda Aptaker (to whom he is distantly related) was out of a job. But not for her anything so mundane as being a dinner-lady - she wanted her own business!

It just so happened that Bernie, apart from being a radio amateur licensed in 1970 with a callsign G4AOG, was also an astute businessman. Envisaging the need for an exchange service through which his fellow amateurs could upgrade their equipment, a partnership was formed between Brenda and himself in 1976, and they rented a small shop at Northfield Road in West Ealing from which to operate. As Brenda says "there was just me, the three new rigs that we could afford, a load of empty boxes on show - and a kettle. It was freezing, and I found that the best way to sell radio gear was to give the client a cup of coffee. It still is!" Bernie Godfrey, on the other hand, was always at the other end of the phone, ready to look after the technical and business end of the outfit.

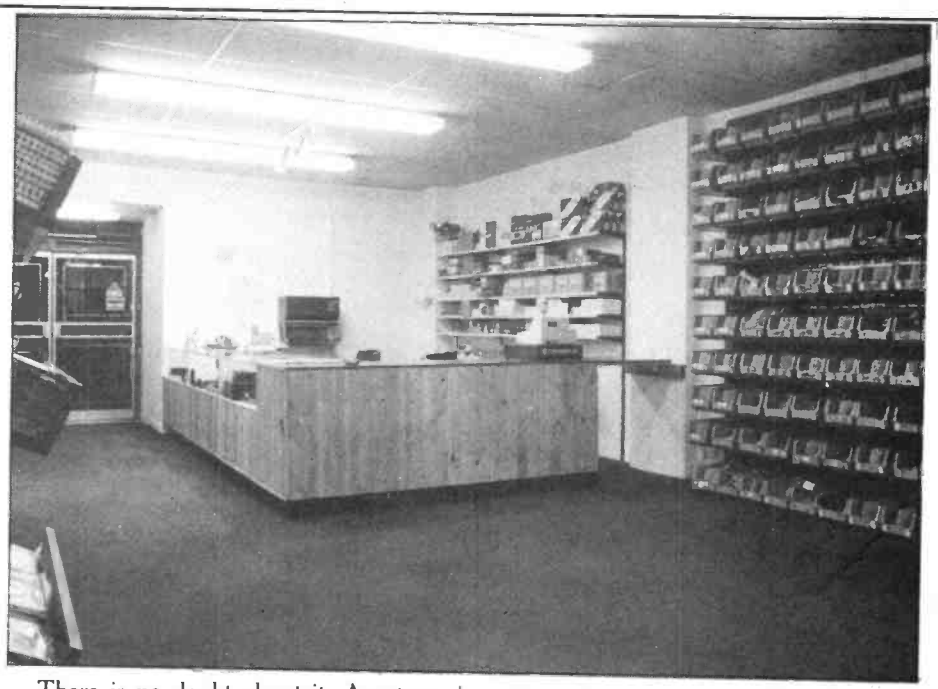
But inside a year, business had become so brisk that Bernie had to move in full-time: Brenda got bitten by the radio bug and took her amateur radio exam in 1979 - an achievement which gained her the callsign G8SXY, shortly to be changed since she won her 'A' class licence after passing the Morse test. And it was largely Brenda who lifted Amateur Radio Exchange off the ground and, in 1982, put them on their way to bigger premises - to 373 Uxbridge Road, Acton, and their current abode. But if the scenery has changed from small beginnings in South Ealing to the double-fronted premises that overlook lush greenery just out of earshot of the North Circular Road, habits haven't. Today, upwards of 50 coffee cups change hands across the counters of Amateur Radio Exchange every working day - only now they have a coffee-maker!

Brenda Aptaker and Bernie Godfrey

And if the premises have expanded, so has the staff; the firm now employs eleven people under the eye of Manager Martin Lynch, three of whom look after the servicing side of the business. What is more, two years ago, a branch of Amateur Radio Exchange was opened in St. Helens, and even ***that*** is expanding under Manager Peter Roberts (G4KKN) and is moving to bigger premises at 38 Bridge Street, Earleston, Newton-le-Willows. Customers in Merseyside can contact Peter on (09252) 29881 for the usual friendly service.

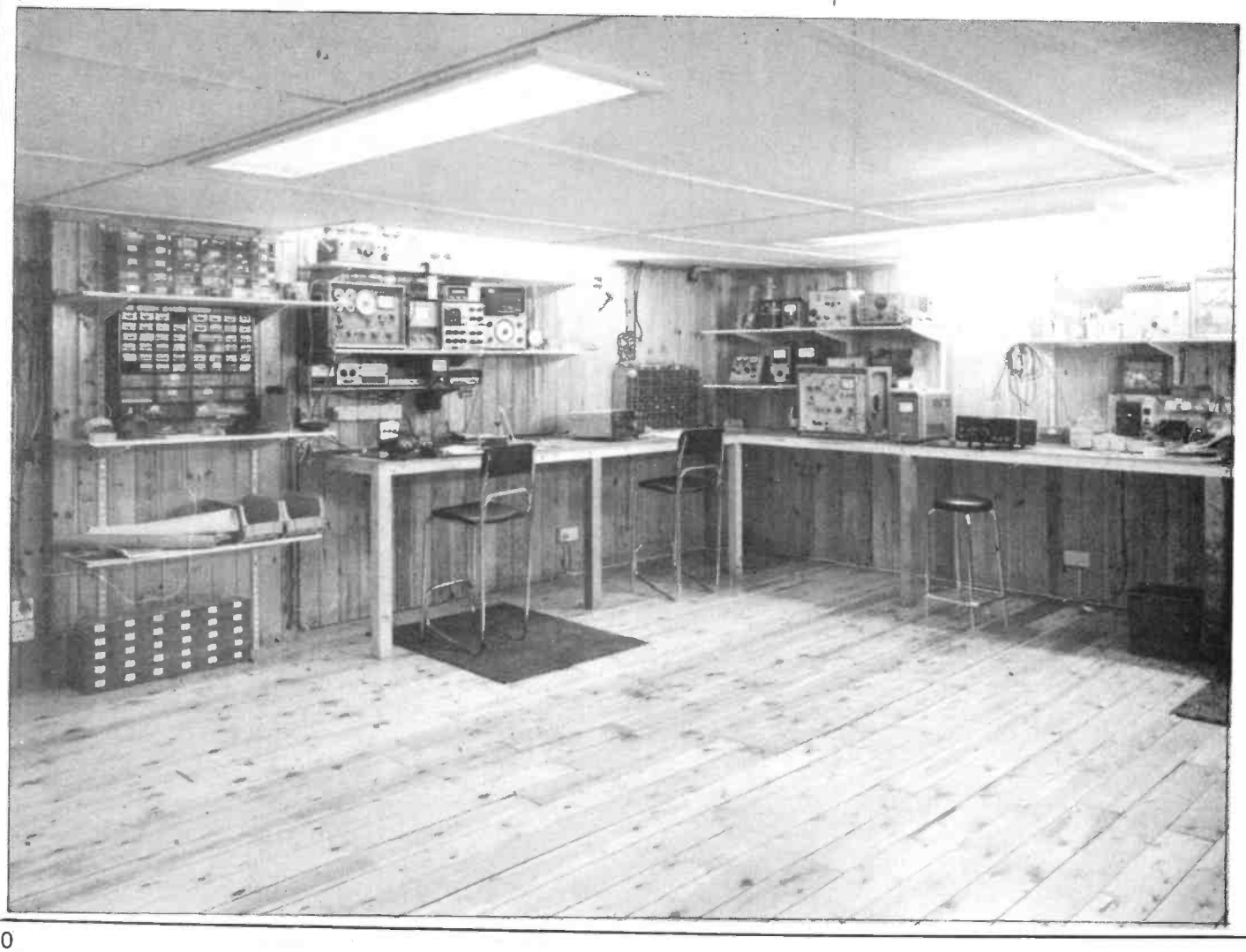
full guarantee

Although Amateur Radio Exchange goes in for direct or 'grey' importing, it must be emphasised that the rights of their customers are in no way reduced - full guarantee periods and service facilities are available. Internal credit facilities, on the ohter hand, are not: nevertheless, arrangements can be made through recognised Hire Purchase organisations to suit customers' requirements. Certainly the word 'Exchange' in the company's title is still as relevant now as it was in the Northfield days of 1976: 'trading in' existing equipment against new, represents a high proportion of the deals negotiated at Amateur Radio Exchange. Customers can expect a mark-down on their original purchase of between 30 and 50% after a couple of year's use.

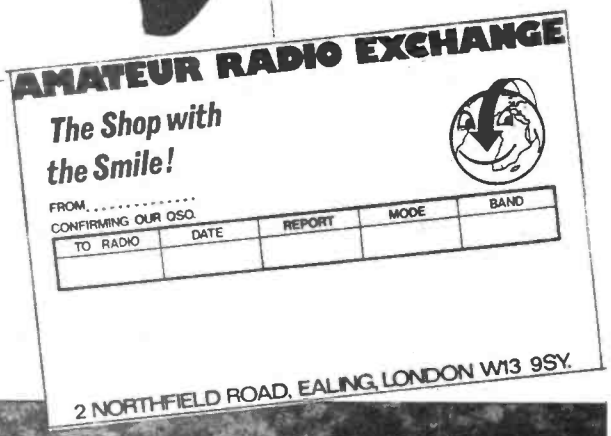


There is no doubt about it, Amateur Radio Exchange is kept very busy. They have three telephone lines, one of which is connected to an ansafone out of business hours (which, incidentally, includes Wednesdays!) It is possible to ring at two in the morning to place an order for equipment, give an Access number and that order will be on its way the next day, as long as it's in stock: and with £100,000 in stock value, they can usually supply it.

Above: a small part of the showroom. Below: the maintenance workshop.



DEALER PROFILE



The sales area at 373 Uxbridge Road is claimed by Bernie to be the biggest in Britain - and, indeed, were it not for a quarter of it that is currently out of commission due to water damage following a fire in the offices upstairs, it *is* the biggest yet seen in the 'Dealer Profile' series. The array of available equipment is quite staggering. "This is the advantage" as Brenda says "of not being tied to any particular make. They are all here, and customers can make a direct comparison between the various types. We will guide them, certainly, but the ultimate choice is theirs to make." And there, on the shelves, was the choice: Yaesu, Trio/Kenwood, Icom, FDK, Tono, Tasco, Welz, Mutek, Adonis and Diamond. As if this wasn't enough, there were also products like Bencher, TET, Alinco, Drae, BNOS, Datong, Strumech, Tonna, J Beam and Microwave Modules.

"The ultimate choice is theirs to make"

But although the business aspects of the firm are largely down to Bernie Godfrey, he is very much aware of, and indeed involved in, the public relations side of the business, along with his partner Brenda - and they attend 50 rallies a year to prove it! The duo are ***not*** into office-chair management, but really enjoy dealing personally with the public on the shop floor. And with a growth-rate that has increased from an £800,000 turnover last year, to one and a half million in 1983, it is all working well: Trio imports alone represent a quarter of a million. If you want to break out of conventional importing arrangements - that's the way to do it!

A mail order service ...25% of their business

Like other retailers of amateur radio equipment, Amateur Radio Exchange provides a mail-order service which, in their case, represents around 25% of the business. On the other hand, what *is* unique is that they can even honour their "have a cup of coffee with Brenda" pledge to clients on the other side of the world: they send them a sachet of the stuff!

Classified Ads

• **SONY** CFR 5090 nine band receiver 5 short long medium VHF airband squelch RF gain BFO battery mains LED and meter tuning, fine tuning AFC £60 ono.

• **WANTED:** Recordings of offshore radio stations 1964 onwards. Caroline, North Sea, Veronica. Need last hour of Mi-Amigo. No land stations wanted. Contact John Black 0235 26807

• **ORIGINAL** AR88D panadaptor type BC1031A mint with manual £50. BC348 unmodified complete with dynamotor £50. Both items plus carriage. Wanted Hallicrafters SX73, national HRO 50T or 60T. Manual for HP410B V.T.V.M. G3GUU QTHR Tel: 0995 40387

• **DATONG** UC1 MMT 28/144, both mint with data £75 each plus postage. AVO CT160 valve tester all test data connectors etc. Immadculate condition £45 plus carriage. HRO spares and G/C coils s.a.e. list G3GUU QTHR Tel: 0995 40387

• **COMPLETE** SWR station consisting of Yaesu FRG7700 receiver - FRT 7700 - FRU 7700 - Tono 550 terminal unit - 9inch YDU and Datong active antenna, cost over £1,000 only 6 months old and all boxed. Will exchange all for complete portable video system. Ring 051-638 5554

• **EXCHANGE:** New motion electronics UHF television sound monitor for Datong AD270 or AD370 or W.H.4. Telephone 0258 53933 Blandford, Dorset.

• **MODULAR** electronics CPM 2513 2M power amp £23. Microwave modules 144/100S auto pre-amp £24. SEM 2M and 4M pre-amps £10. Phone Southampton 782545

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• **ICOM** 2E 2 metre transceiver with spare battery pack charger and speaker/mike unit £120. Tel: 01-470 5089

• **MULLARD** High speed valve tester no cards but working £25 nice condition. Wanted, Drake 2B receiver must be reasonably priced (write). Buyer collects tester. Walker 35/37 Brighouse and Denholme Road, Queensbury, Bradford.

• **FOR SALE:** Quad, electrostatic loudspeaker £100. Also rare valves 6F33. E180F. KT66

• **FANTOVOX** HE50 communications receiver 550 KCS to 30MHz £30 ono. Tel: evening or weekends Reading (0734) 860148

• **WANTED:** Burndept 470 3 channel transceiver. Please phone 0302 835280 after 6 p.m. anytime.

• **ADVANCE** Q1 SIG Gen. BC348 R1155 Kelvin Hughes 24V transceiver. Unused boxed Actal and UX Yanit valves. SAE lists prices 20 Taylor T20 Triodes £2 each unused boxed. A.E. Jeffrey 42 Dennis Road, Padstow Cornwall 532723.

• **REALISTIC** pro 2001 UHF VHF scanner 30 50 MHz 68 88 MHz 144 174 MHz 430 512 MHz direct entry scanner excellent condition tel (0827) 51591 G6 ZCI price £110 ono.

• **SALE YAESU** FRG7 with fine tuner including 2 meter converter £120. K.W. Biggs, 13 Stockton Road, South Park Reigate Surrey, Reigate 48653.

• **WANTED:** PF1 Pye Pocketphones TX and RX preferably crystalled for RB 14 also ned MIZUHO MX2 for new forthcoming licence. D. Giering 80 Wren Road, Greenock, Scotland. 0475 26615.

• **HEATHKIT** solid state 5in oscilloscope DC to 5MHz model 10-102 complete with manual PWO £75 Trio 9R - 59DS communcations receiver excellent condition £45 Amstrad Stereo Amp model Ex330 pwo £30 tel 01-467 54351

• **FOR SALE** Yaesu FT101E HF transceiver Mint condition £350 ono. Phone 0246 417171 (Drowfield) Derbyshire.

• **DRAKE 2B** communications receiver with power supply and Q-multiplier in really excellent condition. £175 this is a collectors item phone after 7pm 01 958 8848 Ivor G6MHI

• **YAESU** FT 227RB 10W FM 2 metre vgc manual orig packing complete with stepper mic mobile mount (unused) £110ono G8LAE Windsor 62166 10 St Andrews Close Old Windsor, Berks. SL4 2QU.

• **SALE KW** Atlanta TXCVR 500 watts pep 10-80 works well also ext VFO £220 phone 0256 Basingstoke 781468 after Sept 28 G4BHE wanted HQ1 minibeam

• **FOR SALE** S27 Hallicrafters 27-145m/cs RX overhauled good cond. collectors item sell at £70 or exchange for good ATV or Datong FL2. Milton Keynes 314095.

• *WANTED* MX4 FT 620 4 meter equipment transverter and amplifier Tel: 01 856 4123

• **PANASONIC** DR 31 communications receiver 32 band perfect condition mains/batt with Yaesu FRT7700 antenna tuner and headphones all new for sale for just £140 for all phone 959 7129 (01) buyer collects.

• **FOR SALE** Hammerlund communications receiver HQ 170 cost £230 any offers also valves miscellaneous. Hardy 12 Fyfield Road, Walthamstow E17 London 3RG.

• **FOR SALE** WPO communications DSB 80m transceiver complete kit half built £50 ono A. Butterworth, West Scots Town Rathven AB52DP Scotland.

• **ROYAL FLYING** doctor service and school of the air 100w HF-SSB transceivers are available to outback travellers, truckers, homesteaders, exploration camps, etc. contact Philip Collins for details Box 295 Artarmon NSW 2064. Tel: Sydney (02) 818 1906.

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• **YAEUSU** frg 7 Ideal starting receiver as new £125 ono. Datong AD270 E15 Tel: 527 7528

• **HEATH KIT** shortwave receiver model SW 717 very good order, with all book information my price £40 ono. Mr. F. Galpin 23 upper Highway, Hunton Bridge, Kings Langley, Herts.

• **WANTED** a pair of 4000 (or higher) resistance headphones. also a battery eliminator for use with old prewar valve set. Please quote price and condition. Ben Brennan, 37 Birling Avenue, Rainham, Gillingham, Kent, ME8 7EY.

• **ELECTRON** ORIC BBC programs morse tutor £4 locator gives distance bearing points, handles lat long QRA QTHL £4 BBC RTTY adjustable speed, auto CR/LF messages £4 T. Tugwell II the Dell, Stevenage Herts. 0438 354689.

• **SWOP OR** for sale Alba 3035 amp Aiwa deck sharp cass pair 70 watt speakers printer wanted with RS232 interface or any good transceiver or reel to reel or anything for texas instruments computer T1-99/4A thank you. N. Gordon 01 677 6555.

• **WANTED** Datong FL2 tel Stockton (0642) 581354

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• **SALE** receivers Yaesu FR101 Ham bands 160m-2m modes AM SSB CW FM NB CW Filter fitted BC bands 60m - 11m £160ono Eddystone 73014 with complete spare set of new valves offers above £85. Tel: 0734 28603 Russel Berkshire.

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• **EDDYSTONE** 880/2 rx. 5-30 MHz 30 bands manual £250. Hallicrafters SX-110 receiver g.c. 5-30MHz bandspd 80-10m amateur, manual £85. G4AFY. Kidderminster Tel: 753358

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December Amateur Radio appears on November 26th 1983

• **SALE** NATO 2000 CB, as new £120 will haggle. M. Wilcox, 16 Happy Valley, Hartlepool, Cleveland.

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• **YAESU** FT290R all mode transreceiver with slide mount mint condition £200; Microwave MML144/30LS £45; Tona 50W Linear £40. Tel: 01 540 3959.

• **ICOM** 25E little used £190; ICOM R70 receiver with F.M. board £390; Azden PCS 4000 excellent condition £160; Discone antenna large type £15. Phone: evening: 0277 823434 daytime: 01592 7800.

• **FOR SALE** YAESU FT277/101 MkI plus matching speaker with phone patch good working order, new valves and double balanced mixer fitted £200. Buyer collects, please phone after 6 p.m. Bracknell (0344) 28218.

• **YAESU FRG 7700** 18 months old in original packing £200 - Tel: 01-370-1000 after 7pm G45FIN.

• **WANTED:** Circuit diagrams or service manuals for any receiver or scanner of any band, any mode. Will refund postage. Tanks - 14 Briars Brook, Lathon, Ormskirk, Lancs. L40 5TH.

• **FOR SALE:** KW2000A HF TX/RX fitted with fan with mic. AC PSU £160 - G4FAJ QTHR - 05433 2169 Walsall.

• **WANTED:** External VFO model 508 and VOX unit for the Swan 700CX TCVR. - Ring 0202 579115 anytime.

• **WANTED:** 2M and HF Aerials. DM81 and power supply to drive FT290 with 25w linear. New Amateur - Peter Baker, Tel: 01 907 7059 Middlesex.

• **ICOM** 251E base rig, 8 months old v.g.c. £420 ono - Tel: Terry, Watford (Herts) 44886 after 6 pm.

• **CENTURY:** 21 communications receiver 0.5 to 30 MHz excellent condition £100 ono - 01-390-1901.

• **WANTED:** Handbook manual for Trio 9R-59 valve communication rewceiver, willing to buy or hire to copy. All expenses paid - D. Parry, 3 Vine Place, Newport, Gwent.

• **FOR SALE:** 30ft Hamtówer 3 × 10ft sections + Top cap plus rotator mount £100 or offers, buyer collects - G41JW - John Woodham, QTHR - Tel: Bristol 621498 after 6 pm.

• **HARRIER** CBX SWR meter Babcock power pack Astatic power mike K.40. Mag mount antenna and Harrier W.T.2 40ch hand held CB £100 or swap for good morse tutor, cash adjustment wither way - A.G. Capon, 5 Great Innings North, Watton at Stone, Herts. Tel: Ware 830841.

• **WANTED:** Amateur QSL cards, send to O.M. A. Graham, 27, Crichton Road, Pathhead, Midlothian, Scotland. EH37 5RA.

• **WANTED:** Small HF rig TS 130 or similar. Phone 05827 61265 evenings.

• **WANTED:** Info and CCT diagram Labgear LG3COTX.

• **FOR SALE:** Harvard 420m FM CB rig with PSU, base station aerial K40 MIC MWR Meter mobile aerial. Offers please to Dave: Praze (Cornwall) 0209 831 745 after 6 p.m.

• **CUSHCRAFT** Monobander 3 element 15 metre Yasi V.G.C. £50 for sale.

• **S.E.M.** 3-way antenna switch, good to 2 metres £10. S.E.M. P.A.5. on board preamp, fits inside rig, suits any 2 metre rig, never used, £6. Both mint. Ring Dino G6RBY 01-446 4932 evenings or 01-247 6097 day.

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• **FOR SALE:** Lowe SRX30D digital comm. receiver 11 months old £120.

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